PROCEEDINGS

OF THE

ASSOCIATION OF OFFICIAL SEED ANALYSTS

OF

NORTH AMERICA

1939

IMPERIAL MYCOLOGICAL
9 AUG 1940
INSTITUTE

Thirty-First Annual Meeting
Madison, Wisc.
August 1-4, 1939

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Edited by:

M. T. Munn
E. H. Toole

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E. Brown	U. S. Dept. of Agriculture	Washington, D. C.
Leatha D. Bunting	State Dept. of Agriculture	Sacramento, California
W. F. Cameron	State Dept. of Agriculture	Springfield, Illinois
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Ruby U. Crouley	State Dept. of Agriculture	University Farm, St. Paul Minnesota
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Margaret Henning	Agr. Exper. Station	Ames, Iowa
Edith C. Higgins	State Dept. of Agriculture	Fargo, North Dakota
A. P. Kerr	State Dept. of Agriculture	Baton Rouge, Louisiana
R. C. Kinch	State Dept. of Agriculture	Lincoln, Nebraska
W. J. Lackey	State Board of Agriculture	Oklahoma City, Oklahoma
J. L. Larson	State Dept. of Agriculture	University Farm, St. Paul Minnesota
C. W. Leggatt	Dept. of Agriculture	Ottawa, Canada
Henry Lunz	State Dept. of Agriculture	Madison, Wisconsin
Anna M. Lute	Agr. Exper. Station	Ft. Collins, Colorado
C. N. McIntyre	State Dept. of Agriculture	Columbus, Ohio
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M. T. Munn	Agr. Exper. Station	Geneva, New York.
Elva Norris	Agr. Exper. Station	Manhattan, Kansas
W. L. Oswald (Honorary Member)	Seed World	Chicago, Illinois
R. H. Porter	Agr. Exper. Station, State College	Ames, Iowa
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William N. Rice	Agr. Exper. Station	Ames, Iowa
Bette Cullinan	Agr. Exper. Station	Geneva, New York
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Dolores E. Weimer	Agr. Exper. Station	Geneva, New York
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W. O. Whitcomb	Agr. Exper. Station	Bozeman, Montana
J. W. Woodside	State Dept. of Agriculture	Raleigh, North Carolina
W. H. Wright	Dept. of Agriculture	Ottawa, Canada

Commercial Analysts

Mary E. Akers	Ross Seed Company	Louisville, Kentucky
Betty Ransom Atwater	Ransom Seed Laboratory	Los Angeles, California
R. M. Comstock	Standard Seed Company	Madison, Wisconsin
Bertha DeHam	Peppard Seed Company	Kansas City, Missouri
Fred S. Emmett	National Seed Laboratory	Toledo, Ohio
Alma Everard	Vaughn's Seed Store	Chicago, Illinois
Ercelle Fuller	Buchanan Seed Company	Memphis, Tennessee
Helen C. Horn	Allied Seed Company	Ft. Wayne, Indiana
Lewis J. LaPine	Albert Dickinson Company	Chicago, Illinois
W. W. Oppel	Courteen Seed Company	Milwaukee, Wisconsin
Helen B. Peebles	J. Chas. McCullough Seed Co.	Cincinnati, Ohio
W. C. Pfaender	Albert Dickinson Company	Chicago, Illinois
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Mary L. Spracher	Northrup-King Seed Company	Minneapolis, Minnesota
Harry E. Vegiard	Crosman Seed Corporation	East Rochester, New York
A. J. Zahorik	L. Teweles Seed Company	Milwaukee, Wisconsin

Visitors

Mrs. J. W. Woodside		Raleigh, North Carolina
Lloyd M. Brown	Albert Dickinson Company	Chicago, Illinois
Mabel Heidt	Commercial Seed Laboratory	Toledo, Ohio
Grace R. Higgins		Fargo, North Dakota
E. D. Holden	Extension Agronomist	Madison, Wisconsin
Fred W. Kellogg	Kellogg Seed Company	Milwaukee, Wisconsin
A. L. King	L. L. Olds Seed Company	Madison, Wisconsin
R. H. Lang	L. L. Olds Seed Company	Madison, Wisconsin
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C. C. Massie		Minneapolis, Minnesota
Mrs. C. C. Massie		Minneapolis, Minnesota
Mrs. C. N. McIntyre & Family		Columbus, Ohio
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M. W. Rowell	Standard Seed Company	Madison, Wisconsin
Alvin Schwendiman	651 University Avenue	Madison, Wisconsin
Ida M. Sirrine		Traer, Iowa
Wilson Stone	L. L. Olds Seed Company	Madison, Wisconsin

MINUTES

The thirtyfirst annual meeting of the Association of Official Seed Analysts was held at the Agronomy Building, University of Wisconsin, Madison, Wisconsin, August 1-4, 1939.

The total attendance at the meeting was 83 persons, of whom 49 were official analysts, 17 were commercial analysts, and 17 were visitors.

Mr.Noble Clark, Associate Director of the Agricultural Experiment Station, University of Wisconsin, gave the welcoming address. Mr. Clark commended the Association on its democratic approach to seed problems. He commented on the wisdom of meeting with agencies interested in the same problems and a common discussion to arrive at the solution of these problems. This, Mr. Clark distinguished from the inadvisability of a highly centralized authority.

Mr. A. L. Stone, Miss Emma F. Sirrine, Mr. F. H. Hillman, and Mr. O. A. Stevens were elected to honorary membership in the Association.

The Secretary made an informal report of the activities of the Association during the past year, the nature and extent of which are indicated in the report of the Treasurer.

The Executive Committee met on the evening of July 31, and formulated a number of recommendations, all of which were approved by the Association in business session.

The Association under the leadership of President L. N. Allen, held a very productive meeting. Much time was given to discussions of the material for a Handbook previously mimeographed and distributed to members of the Association by the Handbook Committee. This material is not included in the Proceedings since the Association left to the new Handbook Committee the question of its final disposition.

The following actions were taken by the Association at the business session:

1. It was moved and carried that the report of the Constitution Committee be accepted. (Constitution and By-laws adopted.)

2. It was moved and carried that the Executive Committee of this Association recommend to the Secretary of Agriculture, the names of the official delegate from this Association and the five delegates to represent the United States at the International Seed Testing Congress which opens on May 20, 1940 in Washington, D. C.

3. It was moved and carried that the report of the Auditing Committee be adopted.

4. The following suggestions for the incoming committee on the Handbook

were made by the Chairman of the Sub-Committee on the Handbook and accepted by the Association:

(a) That a special sub-committee be appointed to bring out an annotated edition of the rules for seed testing which shall include helpful information recommended by the Association for use in the application of these rules and procedure to be followed in cases not covered by the rules. This is to be done in the immediate future.

(b) That the Handbook shall consist of sections dealing with each of the fundamental phases of seed testing and identification of seeds and also papers prepared by those most qualified to write on special subjects which shall form an accumulative fund of information which can be added to the publication from time to time.

(c) That the Handbook Committee be authorized to combine, edit and extend contributions in order to procure precise treatment of subjects for publication. The sub-committee on the Handbook should be authorized to call on any member of the Association or other persons for contribution.

5. It was also voted that the distribution and handling of papers on the Handbook be left to the discretion of the incoming Handbook committee.

6. The following report of the Resolutions Committee was adopted:

(a) Be it resolved: That the Association of Official Seed Analysts of North America at their 31st annual convention held at Madison, Wisconsin, August 1-4 inclusive, wishes to express their sincere thanks and appreciation to:

(1) Professor A. L. Stone of the Agronomy Department and the State Department of Agriculture of Wisconsin and Miss Caroline Hartl, for the excellent arrangements which have made it possible for the members to be together and to enjoy the utmost opportunities for a very successful meeting.

(2) Drs. R. H. Porter and C. W. Leggatt, Messrs. W. A. Davidson, L. A. Moore and Mesdames Betty Ransom Atwater and Ruby U. Crouley, for their musical contribution to our entertainment.

(3) The American Seed Trade Association for their spirit of cooperation as expressed by Mr. F. W. Kellogg of Milwaukee.

7. It was moved and carried that Mr. A. L. Stone, Miss Emma F. Sirrine, Mr. O. A. Stevens and Mr. F. H. Hillman be elected honorary members.

8. The Association adopted the Standards of Germination for Vegetable Seeds for the purpose of state seed law enforcement and also agreed to recommend to the Secretary of the United States Department of Agriculture that they be promulgated as a standard for the enforcement of the Federal Seed Bill, H. R.

5625, if and when enacted into law. (Bill approved August 9, 1939).

9. It was also moved and carried that the Legislative Committee be instructed to resume a very active program to effect the adoption and support by all interested agencies of uniform state seed laws, and further that said committee extend efforts in addition to those of the past, through this organization and through other agencies to encourage enactment in the several states of such laws.

10. It was moved and carried that the proposal to institute a National Seed Week be referred to the Public Service Committee.

11. It was moved and carried that: Pending the adoption of a definite pertinent rule, this Association recommends that chalcis fly or nematode infested red clover and alfalfa seeds that are externally intact be considered pure seed and not inert matter.

12. A motion was made and carried that abstracts of papers be required before presentation at the meeting and that papers that may not warrant publication in the Proceedings be published in the News Letter.

13. A motion was made by the Cooperative Service Committee that "the Association approve the recommendation by the Cooperative Service Committee that the members give serious consideration to the use of a facsimile of the seed label as a major part of the seed analytical and germination test report", which motion was carried by the Association.

14. It was voted that the Secretary should inform the Chairman of the Special Committee of the American Seed Trade Association about the adoption of the Standards for Vegetable Seeds as adopted by this Association.

15. The Association agreed to refer the matter of valuations of "hard seeds" to the incoming Cooperative Service Committee.

A canvass of the ballots showed the election of C. N. McIntyre, Columbus, Ohio, as Vice-President; and W. A. Davidson, Washington, D. C., as Secretary-Treasurer. R. H. Porter automatically becomes President for the coming year.

The chairmen of the standing committees were appointed by Dr. Porter as follows:

Research Committee - C. W. Leggatt, Ottawa, Canada.
Legislative Committee - L. A. Moore, Springfield, Illinois.
Membership Committee - C. A. Stahl, Lansing, Michigan.
Editorial Committee - E. H. Toole, Beltsville, Maryland.
Rules & Regulations Committee - W. O. Whitcomb, Bozeman Montana
Public Service Committee - J. E. Casey, Fayetteville, Arkansas.

It was agreed to hold the 33rd annual meeting in Washington, D. C. in May, 1940, in connection with the International Seed Testing Congress. (Note: The International Seed Testing Congress has since been cancelled)

TREASURER'S REPORT

June 16, 1938 to July 15, 1939

Balance as of June 16, 1938		$1,213.05	
Receipts:			
Laboratory dues	$ 480.00		
Proceedings.....	101.75		
News Letter	34.00		
Rules for Seed Testing	32.60		
Interest on Savings Account	17.39		
		$ 665.74	
			$1,878.79
Disbursements:			
Proceedings	$ 86.00		
News Letter	73.75		
Postage and Stationery	98.25		
Rules for Seed Testing	55.00		
Bonding of Treasurer	5.00		
Dues Int. Seed Testing Assoc.....	50.00		
Miscellaneous.....	12.82		
		$ 380.82	
Balance as of July 15, 1939		1,497.97	
			$1,878.79

W. A. Davidson
Secretary-Treasurer

Approved by Auditing Committee:

C. N. McIntyre

W. H. Wright

PRESIDENTIAL ADDRESS

A DECADE OF PROGRESS IN SEED TESTING IN ALABAMA

L. N. Allen
State Department of Agriculture
Montgomery, Ala.

Seed testing and control work was inaugurated in Alabama in the late summer of 1928 when the speaker entered into the service of the State of Alabama. Anticipating my arrival, there had been ordered a Minnesota chamber, a set of balances and several other minor pieces of necessary equipment.

Almost immediately after arriving in Alabama, the shipment of hairy vetch seed for fall sowing began. The inspection work was not organized and the samples tested were mostly voluntary samples received from parties sending them into the laboratory. From one county came many samples of hairy vetch. These numerous samples were tested and were found to range from 17% to about 40% in germination. Of course, when the results were reported, an immediate reaction to the low vitality occurred. The shipper of this seed immediately sent a salesman to Alabama to "straighten the matter out", as they put it. This man claimed, as we naturally expected him to do, that the seed could not possibly be of as poor quality as was claimed by the state agency. They claimed that the state agency was wrong and that testing their seed and making reports of that nature was harmful to their business and that they refused to stand for it. They immediately made it very plain that the new seed analyst did not know what he was doing. Therefore, they were going to send their own seed analyst to Alabama for two weeks to teach him how to test hairy vetch. This, of course, was satisfactory to us, as we had not the slightest misgivings concerning the results that were obtained from our tests. The seed analyst of the company arrived and was very nice in explaining everything about seed testing and was glad to stay in Alabama two weeks to test vetch seed. We placed samples of seed in the germinator in our respective manners, he using a roll test and I using a folded towel test. At the end of the third day, after looking at the condition of the seed and recognizing the quality by the preliminary examination, it suddenly became urgent that he return to Baltimore immediately.

This case of shipment of misbranded seed was taken up with the United States Government for prosecution under the provisions of the then new Federal Seed Act. This was the first of many of the long series of misbrandings encountered in Alabama. Records presented to the Association by Mr. Davidson at the meeting in Rochester showed graphically the activity of the Department of Agriculture in Alabama with reference to misbrandings in interstate commerce. I might state that the attitude of the seedsman in this first experience has been more or less the attitude encountered all through the years with many of the numerous seedsmen shipping misbranded seed into this State. With an increase in the intensity in the inspection work in Alabama, the worthlessness of the majority of the lots of seed being offered for sale in Alabama became apparent. Germination, weeds,

purity and variety were indiscriminately labeled to suit the wish of the party furnishing the information for the analysis tag.

A very good illustration of the misbrandings may be shown in the following experience. For two or three years after the laboratory had been installed misbrandings of percentages of germination continued. No improvement seemed to be made from year to year. Finally, the Department took more drastic action through seizures and intensified efforts to seek control through Federal aid. As a result, many shippers began to question the results of tests obtained in the Alabama Laboratory. Numerous conferences were held with shippers of seed who came to Montgomery. Several shippers were frank to admit that their seed were labeled 90% germination because the trade demanded it. They said, "they could not sell rye if it were not labeled 98% purity and 90% germination and, therefore, placed that information on the analysis tags". In the year to which I refer, 90% of the rye which was tested showed a vitality in the neighborhood of 70%. Consequently, the shippers, apparently having been convinced that they could not label seed 90% germination for sale in Alabama when it did not so germinate, lowered the labeled percentages on rye the following year to 70%. These percentages, it later developed, were guess figures based on the results of the analyses made the preceding year. As it happened and for some unknown reason, the vitality of the type of rye sold in the State of Alabama was considerably lower than 70% and the majority of the samples tested ranged in the neighborhood of 30% or 40% germination. Conferences again were held relating to the misbranding of rye and it was frankly admitted that the seed had not been tested again but, "were labeled 70% germination because that was what they had tested the year before". From this time on conditions began to look up in seed control as far as labeling the germination percentages was concerned. The following year there was no uniformity in the labeling of germination as indicated from the seed offered for sale. The percentage of germination labeled on the analysis tags varied from 60% up through 90%. The labeling indicated actual germination tests probably had been made in most cases. The results in comparison with tests in this laboratory showed a closer degree of conformity of the labeling to the actual value of the seed. In few cases was trouble encountered, except in occasional cases where guesses were made as to the percentage of germination.

At the same time that our efforts were being devoted toward germination percentages with reference to rye and other seeds, it was found that much of the oats being shipped into Alabama from Texas contained high noxious weed counts with a labeling that no Johnson grass was present. The first two years reports showing these discrepancies failed to bring about any recognition by the shippers of the fact that the seed which was being offered for sale in Alabama bore statements which misrepresented their quality. As a result, it became necessary, therefore, again to take drastic action. This time oats found containing Johnson grass and which were mislabeled were removed from sale and seizures were made. In one instance, a car-load of oats containing 23,000 Johnson grass seeds to the pound of oats was seized and burned. Smaller lots were destroyed in similar amounts in other sections of the State. The results brought about from taking this drastic action were most gratifying. Where it was formerly a rule to find high rates of occurrence of Johnson grass seeds in oats, it is now an exception to find any oats with Johnson grass. Shippers realizing they could

not sell oats when labeled with the presence of Johnson grass seed, even in the smallest quantities, have installed seed cleaning equipment for the removal of Johnson grass. This equipment up to the present time, apparently, is most efficient in the work it does.

The first misbranding of varieties in Alabama brought to the attention of the officials in charge of the enforcement of the Federal Seed Act was that of the sale of so-called Abruzzi rye in Alabama. Abruzzi rye is a type of rye which is adapted to the southeastern section of the United States and makes abundant early growth, thus furnishing green material for grazing in the winter time. No other type of rye equals Abruzzi rye in this respect. Abruzzi rye seed is usually scarce and, therefore, sells at a premium, possibly bringing $2.50 a bushel, while other types of rye bring $1.00 or less. The practice has been, therefore, for unscrupulous seedsmen to purchase cheap rye and sell it at a premium as Abruzzi rye. The resultant plant growth, of course, is unsatisfactory and worthless for the purpose for which it was intended. In the first instance of seizure of rye which was misbranded as to variety, it was very evident from the presence of certain weeds that the so called Abruzzi rye was not grown in the region in which Abruzzi rye would grow. When the seizure and destruction of this particular lot was made, a representative of the company very frankly admitted to me that he "did not think there was any difference in Abruzzi rye from any other kind of rye and, therefore, since his trade had wanted Abruzzi rye, he had instructed his concern to label such rye in accordance with the wishes of the purchaser". Samples of rye have been planted in Alabama since 1929. Portions of such samples have also been supplied the Division of Seed Investigations in Washington and have been further checked through planting on the test plots at Arlington. A press release from the United States Department of Agriculture under date of June 26, 1939 indicates that in 1930 approximately 28% of the shipments of Abruzzi rye into the South (mainly Alabama, were of the Rosen variety. Activities of the Federal Seed Act reduced this misbranding in 1933, 1934, 1935, and 1936, when in latter year about 15% of the shipments of Abruzzi rye proved to be Rosen. In 1937 and 1938 the percentage increased. It was along about this time that is was noised about that the Federal Seed Act was inoperative and convictions could not be gotten for shipping misbranded seed in interstate commerce.

An interesting experience occurred in the year 1932 when shipments of Sorghum cane seed coming into Alabama were labeled 85% germination. These seeds when tested in the laboratory in Montgomery proved to germinate, in the majority of cases, in the neighborhood of 30% to 40%. In some instances, samples from small lots and individual bags tested as low as 15%. There was a total of six cars which came into Alabama. About half of these were found in time to be confiscated and prevent distribution to the farmer. This seed was labeled as "New Crop Seed" but shipping records showed it had been in storage two years in Texas. Investigation also revealed that approximately 28 car-loads of this seed were distributed to the farmers in the sorghum cane growing belt. Furthermore, the shipper very frankly admitted that Alabama was the only state in which any of their products had been sampled and found to be misbranded. The speaker, in an effort to advise seed control agencies in other states, sent out samples for testing with specific information as to the percentage of germination found and

the name of the shipper. An additional car of this seed was later found in Memphis, Tennessee and proved to be misbranded likewise.

In mentioning misrepresentation of varieties, I should not fail, at this time, to tell about our experience with soy beans. In Alabama we have a long growing season. Therefore, we require plants which will grow for a long period of time before maturing, in order that the best results might be obtained and greater certainty might be had in the production of a crop. High temperature and dry weather are certainly limiting factors in agriculture in the South. Therefore, plants must begrown which are able to withstand long periods of dry weather and which are adapted to high temperatures. In the case of soy beans, certain varieties meet the requirements for growing conditions in the South. Unfortunately, there are no distinquishing characteristics of the seed. As a result, it is impossible to distinquish the adapted variety of any seed from varieties having seed of a similar color, shape and size. This, of course, makes it possible to misrepresent varieties and such misrepresentations can not be told until the plant has grown to maturity. Otootan soy beans and Laredo soy beans, two varieties adapted to the South, have black seed which are similar in shape, size and color to the Wilson and Ebony and other varieties used extensively in the North. Otootan and Laredo soy beans, because of their adaptability and scarcity, sell for several dollors a bushel, whereas the Ebony and Wilson and other unadapted varieties may be purchased on the bean market and from oil mills in the North for possibly $1.00 per bushel. A wide discrepancy in the price lends a great temptation to unscrupulous parties and, as a result, substitutions quite frequently are practiced. The farmer, of course, loses an entire hay crop when the misbranded seed are delivered to him, for these unadapted varieties will hardly grow more than 6 or 8 inches in height, while the Otootans and Laredoes are adapted varieties which will always obtain a height of 3 or 4 feet or more, regardless of weather conditions.

When inspection work started, about 60% of the soy beans delivered to Alabama farmers were misbranded as to variety. Varietal testing and continued intensive activity of the Department in resorting to confiscation and filing of complaints in Washington for violation of the Federal Seed Act brought a reduction to zero of the misrepresentations in 1936, 1937, and 1938. I regret very much to say that in the last two days there have come into the office four complaints of misbranded varieties sold as Otootan soy beans. The year 1939, therefore, has seen the sale of misbranded soy beans and the loss to many farmers of their hay crops for the first time since 1935. There have been innumerable other isolated instances of misbrandings with almost every shipper of seed into the State of Alabama. I note with satisfaction, however, that an improvement has been made and that Alabama ceases to be, to a large extent, a dumping ground for worthless seed. I believe, when the Federal Seed Act again is placed in force, that Alabama, a s well as other states, will profit greatly through the necessity of sellers in meeting the stated labeling requirements.

Besides testing the varieties of seeds by planting in the fields, close examination has been made of certain other types of seed to determine the presence of seeds other than those named on the analysis tag. Some work has been done with various varieties of cane seed and considerable more has been done with the varieties of oats. In 1935 the legislature threw the problem of

varieties squarely up to the seed control forces by incorporating in the law the requirement that the variety and common name be given on the analysis tag. Laboratory work on varieties of oats, therefore, was started due to the fact that there had hardly been a year when one or more complaints had not come to this office from farmers who had been sold mixed varieties of oats as a pure type. Following our usual practice, therefore, for two years the Department of Agriculture notified shippers of the presence of mixtures or of the use of names not strictly varietal. In the fall of 1938, little heed having been paid to these warnings, the Department thought it necessary to take drastic action. Seizures were made and many bushels of such seed were removed from sale. I wish to take this occasion, however, to pay tribute to those few concerns who, recognizing the conditions prevailing and the necessity of complying with the law, refused to ship into the State of Alabama oats which they knew definitely would not meet the requirements of the Alabama Seed Law. This illustrates the splendid cooperation that in recent years has been manifesting itself with those parties having to deal with the control agencies in Alabama. Some few concerns, however, have taken an antagonistic stand, as was to be expected, and have denied the ability of any one to distinquish the variety of oats from the seed characters. Definitely, we know, however, that this can be done because we have been doing it for the last three years. As a result, we are finding very few lots of badly mixed oats slipping into the market to be used in the seed channels.

Our first experience with the varieties of oats occurred when it was discovered that northern grown White oats were being sold as so-called Mammoth Cluster oats. The varietal characters of this oat are different from those of the type ordinarily shipped into Alabama. These so-called Mammoth.Cluster oats proved to be Victory oats, being "dressed up" with a fancy name for sale purposes. Seizures were made wherever these oats were located on the market. Two years later this same concern secured and sold a type of oats as Sun Field Selection Ferguson Strain Red oats, a variety which is very appropriately adapted to southern conditions and is a high yielder. These oats, upon examination in the laboratory, were found not to be of the variety labeled. In addition, the percentage of germination on these oats was about 30% lower than that labeled. These oats, likewise, were removed from sale through confiscation.

I wish to take this occasion to thank the agencies of the United States Department of Agriculture for the assistance they have given in confirming the many misbrandings of seed in Alabama. It has been the policy of the Alabama Laboratory to keep federal agencies thoroughly informed at all times of the work it was undertaking and to secure advice and cooperation from them. This, they have most willingly supplied. I do not believe that any progress would have been made in Alabama without the aid and assistance of the federal agencies on which we called. State control is one thing and interstate control is another. Without, therefore, that so necessary cooperation from the Federal Government, no state would be able to proceed in any manner that would enable it to control any shipper not wishing to comply with the provisions of its law.

Much has been said in recent years about seed enforcement agencies being too strict but no admission has been made about the necessity for such strictness.

Personally, in looking around me, I do not believe that any state is covering the job of seed testing as thoroughly as it should be covered. I believe, if the seedsmen were to complain that a laboratory was not doing a good thorough job, that they would be far more justified than in complaining that a laboratory or state agency was too strict. In many of the states, inspection fees are charged on seed. Yet, these same states quite frequently do not devote this money to the cause for which it was intended. Here, if anywhere, is the place that complaint and criticism should be directed. My observation has been that there is far less trouble in states requiring an inspection fee than in states not requiring an inspection fee. Paying for something seems to make it bear an enchantment of greater appreciation than do free services. As I have said, I believe that many of the control agencies are falling far short of the purpose for which they were intended. It is my belief that more time should be devoted to the testing of inspection samples and less to the testing of samples from individuals over the state. In the majority of cases, time and space devoted to such samples is wasted. I would recommend that official laboratories discontinue the testing of seed from lots to be placed in commerce and make tests of lots only from commerce and when collected in an authorized manner by an inspector. If you feel it is necessary to test samples for farmers, then this testing should furnish only information to be used as a guide in planting and should be done in the off season when inspection samples are few.

The aim of the Seed Law is to protect the consumer. It is up to us as members of the enforcement agencies, therefore, to give our very best to see that the maximum protection be afforded through field inspection. If we slip on the job or if we confine our efforts to too narrow a field, then we are not doing the best that can be done. Each one should strive to render the best service that is possible for him to render in carrying out his duties.

We are equipped in Alabama for laboratory tests, greenhouse tests and field tests and we have a splendid set of modern laboratory equipment. With what we have done, we still feel the field of endeavor is wide open and that we have only begun to scratch the surface. We hope to broaden the scope of the work and thus enhance the effectiveness of the Seed Law through better inspection and an increased personnel and laboratory equipment. We want to render all the service possible and the very best service possible to the people of Alabama.

REPORT OF LEGISLATIVE COMMITTEE

The Progress of the Federal Seed Act

C. N. McIntyre - for the Legislative Committee

Last year at the annual meeting, you will recall that we were favored by an address from Dr. M. A. McCall, on the Federal Seed Act. At that time Dr. McCall was informed by the legislative committee, of our sincere interest in the development of this Act. In December of last year Dr. McCall called a meeting for the purpose of discussing various changes in the wording and arrangement of the Act. Those present included members of the American Seed Trade Association, Members of the Seed Policy Committee of the U.S.D.A., members of the International Crop Improvement Association, Members of Seed Producing Associations and members of the Association of Official Seed Analysts. The following members of the Seed Analysts Association were present:- M. T. Munn, W. A. Davidson, L. A. Moore, C. A. Stahl, L. N. Allen and the writer. Mr. Munn represented the New York Seed Improvement Association and Mr. Moore the Seed Council of North America. Mr. Davidson is a member of the Seed Policy Committee

After congress reconvened in 1939 the seed act was designated H. R.3366. On March 23, 1939 a hearing was held before the Committee on Agriculture of which Mr. Marvin Jones was chairman. In general the same interests were represented. The bill by this time had been designated H.R. 5625 and was in such a form as to be considered an agreed bill and as such was endorsed by the American Seed Trade Association, Farm Bureau, Grange, Association of Official Seed Analysts and the Co-operatives, such as G.L.F. and Federated Seed Service.

At this hearing the Association of Official Seed Analysts was represented by L. A. Moore, W. A. Davidson and the writer. However, the G.L.F. and allied interest objected to the total live seed statement and asked that this item be removed. This point was well taken and was in line with some of the criticism voiced by several states.

During the discussion of the bill some of the members of the House Committee injected the question of Farmer exemption. At the request of the Committee a section covering this point was writen. The inclusion of such a section was received by general protest, not so much because of the volume of business involved but for the bad precedent in a law which was to be held in general as a model for new state legislation. When the committee reconsidered the section some desired to avoid regulation of the farmer and rewrote the farmer exemption section. Again the seed trade and our committee contacted all the interests to have the committee reconsider this section. However, it became apparent that if the bill was to be voted out of committee the farmer exemption section must be retained. It is said to have been intimated that if passed out of committee without this section some of the members would work against the bill on the floor of the House. Mr. Coffee was able to make an amendment to the bill which had the tendency to restore the intent of the so called "Farmer exemption clause" as originally written. This bill as passed by the House was read in Senate Committee and placed on the calendar for senatorial action. My last effort to

get the bill up to a vote was to request the Commissioners of Agriculture and other interests of the States in which a Senator held a membership on the Rules Committee, to request the Senator to advance the place of this seed act on the calendar.

Report of the Conference on Germination Standards for Vegetable Seeds

C. N. McIntyre - for the Legistative Committee

Last year as chairman of the Legislative Committee, it was my privilege to collect information relative to germination standards for vegetable seeds. The information collected has been placed in your hands. This information seems to be about all the statistics available in the hands of administrative agencies and is based on actual laboratory findings. These findings undoubtedly include carry over seed and this fact would tend to cause the averages to be lower than normal new crop seed. What the rela tive proportion of carry over seed bears to the new crop seed is not known. The State of Virginia has kept the most extensive records on samples purchased on the open market. These cover a 13 year period. This does not mean that the records of other states are of no value but implies that the Virginia records represent average conditions.

What records the seed companies have to offer concerning the actual laboratory findings, I do not know. I do know, however, that much information has been requested of seedsmen by administrative agencies and this together with the actual findings have been the basis of the present standards adopted in most of the states.

The meeting held on July 14th, 1939 at Columbus, Ohio by a special committee of the American Seed Trade Association and representative of the legislative committee of the Seed Analysts Association was for the purpose of trying to unify the thought on germination standards. It was the opinion of the members of this meeting that the standards should be low enough to permit normal seed transactions and at the same time guarantee to the buyer the possibility of a normal crop.

The germination standards should be high enough to keep low quality seed off the market, unless distinctly labeled. There should be no distinction between seed sold in bulk and that sold in packets.

It should be kept in mind that the proposed Federal Seed Act authorizes the Secretary of Agriculture to set up germination standards and that these standards can be varied to meet any emergency that may develop in any one season for any one kind of seed. This fact will take care of the problem of the below normal years, and should not greatly influence the selection of standards based on average normal production. Again, it should be kept in mind that the sale of the low viability seed is not prohibited under the Federal Seed Act, such seed is required to be plainly labeled with the words "Below Standard" and in addition must show the results of the germination test. Again if any dealer handling a better than standard grade desires to so-advise the purchaser

and make claims for this higher test, the ordinary rules for tolerance should apply. In such cases the dealer should not be permitted to defend on the grounds that seed is above standard.

Generally speaking it is the opinion that no tolerances should be applied to minimum germination standards. It is true however that the Federal Seed Act requires tolerance to be applied in determining whether the seed is above standard.

The standards as presented have been accepted by the American Seed Trade Association and the members of the Legislative Committee. We now offer them to the association for any action which it may care to take with reference thereto. If acceptable to the Association these germination standards will be recommended to the Secretary of Agriculture, if and when the Federal Seed Act is enacted or when the question of standards and other regulations is raised.

MINIMUM STANDARDS OF GERMINATION FOR VEGETABLE SEEDS

Schedule proposed by joint conference of Legislative Committee of Official Seed Analysts and Special Committee of American Seed Trade Association meeting at Columbus, Ohio, July 14, 1939.

(Subject approval of Association of Official Seed Analysts Convention in Madison, Wisconsin, August 1939).

Artichoke	60%	Onion	70%
Asparagus (incl. hard seeds)	70%	Parsley	60%
Beans (except Lima)	80%	Parsnip	60%
" Lima	70%	Peas	80%
Beets, incl. Swiss Chard	65%	Peppers	55%
Broccoli	75%	Pumpkin	75%
Brussels Sprouts	70%	Radish	75%
Cabbage	75%	Rhubarb	60%
Carrot	55%	Rutabaga	75%
Cauliflower	75%	Salisify	75%
Celery & Celeriac	55%	Sorrel	60%
Chicory	65%	Spinach*	60%
Collards	80%	*(except New Zealand)	
Corn	75%	Spinach, New Zealand	40%
Cucumber	80%	Squash	75%
Dandelion	45%	Swiss Chard*	
Egg Plant	60%	*(See beets)	
Endive	70%	Tomato	75%
Fetticus (corn salad)	70%	Tomato, Husk	50%
Kale	75%	Turnip	80%
Kohlrabi	75%	Watermelon	70%
Leek	60%	Citron	65%
Lettuce	80%	Cress, Upland	40%
Muskmelon	75%	" Water	25%
Mustard	75%		
Okra	50%		

Herbs are omitted as not being vegetables and therefore laws applying to vegetables are not applicable.

Representing the American Seed Trade Association	Earl Page, A.W. Livingston, R.H. Coulter
Representing the Association of Official Seed Analysts	C.N. McIntyre, W.A. Davidson, L.A. Moore

UNIFORM STATE SEED LAWS

W. A. Davidson - for the Legislative Committee

You are no doubt familiar with the activities during the last year that resulted in publicity pertaining to the desirability of uniform state legislation. These activities have been sponsored by the Council of State Governments. The National Association of Secretaries and Commissioners of Agriculture, and the Federal Department of Agriculture.

The Association of Official Seed Analysts is to be congratulated on its foresight in recognizing the need for uniform State seed legislation. One of the original projects assumed by the Association at the time of its formation in 1908 was to develop desirable uniform State seed legislation. A joint recommendation was made with the American Seed Trade Association in 1917. It has been felt from time to time that there was not sufficient effort made in behalf of the adoption of this uniform bill in more of the states. The state seed laws do have more or less variation, but it must be said that in principle they adhere to the uniform state seed bill sponsored by this Association.

The enactment of a Federal seed law requiring labeling in interstate commerce administered, as anticipated, in cooperation with state seed officials emphasizes the importance of uniform state seed legislation. The Association has in tentative form a proposed uniform vegetable seed bill that has been discussed with the American Seed Trade Association, but the adoption of it has been withheld pending the developments of Federal seed legislation. Consideration needs to be given to changes in the uniform field seed bill.

It would seem appropriate for the Association to resume a very active program to effect the adoption and support by all interested agencies of uniform State vegetable and field seed laws. It would seem advisable for the Association to instruct the Legislative Committee to extend efforts in addition to those used in the past, through this organization and through other agencies, to bring about the enactment in the several States of seed legislation that is uniform in nature.

It is not too soon to make preparations for the consideration of this matter that will no doubt be given in most of the States when the legislatures convene in 1941.

THE OCCURRENCE OF WEED SEEDS IN COMMERCIAL SAMPLES OF VEGETABLE SEEDS.

C. A. Stahl - for the Legislative Committee

In 1937 the committee on legislation undertook to make a study of the frequency of occurrence of weed seeds in vegetable seeds with the idea of determining if it would be advisable to outline or recommend legislation to regulate the sale of seed found to be contaminated with noxious or harmful weeds.

When this task was undertaken by the writer at the request of the chairman

a search was immediately made for literature or other information on the subject. Practically nothing of a current nature appeared to be available. Some of our laboratories voluntered to assist in the project but completed reports were not available at the time of the 1938 meeting. The report that was made was based largely upon the information contained in a publication by the New York experiment Station published in 1932. At that time it was decided to consider the report as incomplete, or of a preliminary nature with another report to be made at the 1939 meeting

For the purpose of making this study the laboratory had on hand 673 samples of vegetable seeds. These samples were carefully examined for weed seeds and Table 1 summariezes the findings on the 673 samples.

It was found that a total of 223 samples carried weed seeds of one kind or other. The 673 samples examined represented 40 different kinds of vegetable seeds; 12 kinds were found to carry 22 different kinds of weed seeds. It will be noted in the tabulation that samples of carrot seed carried more weed seeds and more different kinds of weeds than any of the other kinds of seed. In this respect carrot is followed closely by celery, cress, endive, and lettuce. It is noticeable that lamb's quarter appeared with the greatest frequency which was followed by lady's thumb, barnyard grass, and pigweed, - other weed seeds appearing in lesser quantities.

One of the significant features in this study appears to be that the weed seeds, namely Canada thistle, dodder, and quack grass, which have received more attention by State legislation than any other of the weeds, are not to be found in this tabulated report. It may be possible that state field seed regulations have to some extent benefited or tended to lessen the prevalence of these same weeds in our vegetable seeds. It is also noticeable that very little mustard was to be found in the samples examined. It is altogether possible, however, that some mustard may have been present in some of the Brassicas and escaped the notice of the analyst. While the weeds more commonly designated as noxious appear to be in the minority, the weed seeds that were found could hardly be ignored as many of them present a very serious problem in some states where they are found.

The work that has been done has largely been upon seed that is being offered for sale in packets. Possibly 20% of the samples represented bulk lots of seed. No doubt seed sold in bulk lots carrying weed seeds would receive a wider distribution and create a more serious menace than seed being offered for sale in packets.

The conclusions in this study by the writer are approximately the same as outlined in the preliminary report submitted in 1938. While the need for legislation does not appear to be great, one of the primary objects of seed legislation is to prevent the distribution of weeds, and it seems that the weed seed content of vegetable seeds should not be ignored by any agency interested in the improvement of the agricultural conditions in either our states or country. It would seem advisable that all states having seed laws should attempt to examine and regulate the sale of bulk lots of vegetable seeds, and lots carrying

noxious weeds should be subject to approximately the same regulations that the state or federal laws carry for field seeds.

Table 2 presents a summary of results submitted by the Alabama laboratory and the results from the Michigan laboratory.

TABLE 1. - WEED SEEDS IN COMMERCIAL SAMPLES OF MICHIGAN VEGETABLE SEEDS.

	Number of samples with weed seeds for each kind of Vegetable Seed											
Kind of weeds	Carrot	Celery	Cress	Endive	Lettuce	Parsley	Parsnip	Pepper	Radish	Salsify	Spinach	Tomato
Barnyard grass	9											
Bindweed	4					3			1		4	
Black nightshade		1		4								
Buckhorn	1											
Catchfly	1		1									
Charlock	3			4		2	1	1		1		1
Chickweed			1			2						
Crab grass		1										
Dock	5			2		1						
French weed	1		2	1								
Indian mustard			1									
Ladys thumb	10		2						1			1
Lambs quarters	61	8	4	5	8	6						
Pigeon grass	1	2		4	1	2	1	1				1
Pigweed	6	7		3	10	1						
Ragweed				1								
Sorrel					1							
Thyme		2										
Tumbling amaranth		2			3							
Witch grass					1							
Yellow foxtail												1
Yellow rocket			5									
Total number samples examined	99	41	5	18	103	44	65	40	106	20	43	89

TABLE 2. - WEED SEEDS IN VEGETABLE SEEDS

	Total No. of Samples	Total No. of Kinds	Kinds with Weed Seeds		Samples with Weed Seeds		Samples with noxious Weed Seeds	
			No.	%	No.	%	No.	%
Alabama 1936-37	328	24	15	62	89	27	3	1
Alabama 1937-38	237	18	10	55	83	35	1	.4
Michigan 1938	673	40	12	30	223	33	0	0

Weed Seeds found in Vegetable Seeds arranged in the order of their occurence

Kind	Number of samples
Lamb Quarters(Chenopodium album)	89
Pigweed (Amaranthus retroflexus)	27
Lady' thumb (Polygonum Percicaria)	14
Charlock (Sinapis arvensis)	13
Pigeon Grass (Setaria viridis)	13
Cornbind (Polygonum convolvulus)	12
Barnyard Grass (Echinochloa crus-galli)	9
Dock (Rumex crispus)	8
Black nightshade(Solanum nigrum)	5
Tumbling amaranth (Amaranthus graecizans)	5
Yellow rocket (Barbarea vulgaris)	5
French Weed (Thlaspi arvense)	4
Chickweed (Alsine Sp.)	3
Catchfly (Silene noctiflora)	2
Buckhorn (Plantago lanceolata)	1
Crab Grass (Digitaria sp.)	1
Indian Mustard (Brassica juncea)	1
Ragweed (Ambrosia elatior)	1
Sorrel (Rumex acetosella)	1
Witch Grass (Panciun cappillare)	1
Yellow foxtail (Setaria lutescens)	1

REPORT OF COOPERATIVE SERVICE COMMITTEE

Forms of Reports used by Seed Testing Laboratories [1]

W. O. Whitcomb, Chairman

The furnishing of the results of a germination test and an analysis to the owner of the seed is an important part of seed analytical work. A survey of the report forms used by the official seed testing laboratories of 46 states and the Federal laboratories of the United States and Canada shows that there are seven items of information commonly supplied in various ways and in varying degrees of detail. In addition to these, there are other items such as grades and diseased condition of seeds which are furnished by some laboratories.

The seven items of information most commonly furnished are:

1. Kind of seed.
2. Pure seed percentage, or more properly, seed under consideration.
3. Germination percentage, and hard seed, if present.
4. Other crop seed percentage.
5. Total weed seed percentage.
6. Names of noxious weed seeds and number of each per pound of seed.
7. Inert matter percentage.

Forms of Reports

To meet the varying conditions and the local needs found in the different states and in Canada, a number of different forms of laboratory reports have been developed. A study of these forms during the past few years shows that they have been modified to a marked degree in many cases and current information indicates that other changes may be expected in the near future. The object of this survey is to make available to the various laboratories brief summaries of the various forms now in use that they may be used to advantage in working out new seed testing report forms.

Separate Sheets for Purity and Germination.- As shown in Table 1, there are 15 laboratories which used one sheet for reporting purity and another for reporting germination. This was the method commonly employed by many laboratories when seed testing was in its infancy and purity reports were sent out before the germination was complete, but since testing methods have been improved and the work has been speeded up, many laboratories now make both reports on one sheet. No doubt there are valid reasons, however, for certain laboratories to continue reporting purity and germination results on separate sheets.

Facsimile of Seed Label as Part of Report. - In recent years, the practice of writing certain analytical data directly onto a facsimile of the label as a part of the report has been adopted by a number of laboratories. This procedure has apparently been the outgrowth of using the label to aid in explaining how to use the data in the report.

As shown in Table 1, 18 laboratories are now using a facsimile of the seed

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1. Contribution from the Montana State College Agricultural Experiment Station. Paper No. 137 Journal Series.

label as part of the report in some form or another. Some laboratories make this label the major part of the report and supplement it with certain detailed information, while others merely show the form of the label on the report and do not fill in the data.

It is the belief of the committee that the use of a facsimile of the label as a major part of the report is highly desirable and it is recommended that laboratory officials, who are contemplating making changes in their methods of reporting results, give this method serious consideration.

Actual Value of Seed.- As shown in Table 1, 17 laboratories are now following the practice of giving a figure on the report showing the actual value of the seed. This figure is obtained by multiplying the percentage of germination by the percentage of pure seed and dividing the product by 100. This figure is the percentage of pure live seed found in the bulk lot. The percentage of germination of the pure seed, as usually given, is too high, especially in seed of low purity, and the term "actual value" gives a truer figure. The notes which accompany Table 1 are of special interest.

TABLE 1. - FORMS OF REPORTS AS TO, (1) USE OF SEPARATE SHEETS FOR PURITY AND GERMINATION, (2) FACSIMILE OF SEED LABEL AS PART OF REPORT, (3) "ACTUAL VALUE OF SEED", SHOWN ON REPORT.

Laboratory	Separate sheets for purity and germination[1]	Facsimile of seed label as part of report	Actual value of seed shown
Alabama		X	
California	X		X
Canada			X [6]
Colorado		X [2]	
Connecticut	X		
Delaware			X
Idaho	X	X [3]	
Illinois	X	X	
Indiana	X		
Iowa (State College)	X	X [4]	X [7]
Kansas		X [5]	
Kentucky	X		
Louisiana		X	
Massachusetts		X	
Michigan	X	X [2]	
Minnesota		X	
Mississippi		X	
Missouri	X		
Montana		X	X
Nebraska		X	
New Hampshire		X	X
New Jersey	X		
New Mexico	X		
New York	X	X	X
Ohio		X	X [7]
Oregon	X		
United States Department Agriculture	X		X [8]
Virginia		X [3]	
Washington	X		
Wisconsin		X [5]	
Wyoming			X

1. Other laboratories have one sheet for regular reports. Many laboratories have a special sheet when "germination only" is requested.
2. A special sheet giving a facsimile of the label is attached to the report. This is occasionally filled out with data from the report.
3. A regular seed label is filled out with data from the report.
4. Facsimile on separate sheet sent to farmers but not to seed houses.
5. Facsimile on report is not filled out.
6. Canada - Use the term "Pure live seed". This applies to eight laboratories.
7. Statement made on report how to determine index value (actual value)
8. Term "Live pure seed" is used. Given only for samples on which germination alone is requested.

Weed Seeds and Other Crop Seeds. - Methods of reporting weed seeds (other than noxious) and other crop seeds have probably changed as much during the past few years as any feature in the seed analysis report. A consideration of this part of the report form does not include noxious weed seeds because they are clearly defined by the various seed laws and the methods of reporting are stabilized. The tendency seems to be to give more detailed information than formerly.

TABLE 2. - METHOD OF REPORTING WEED SEEDS (OTHER THAN NOXIOUS) AND OTHER CROP SEEDS - LISTED SEPARATELY.

Laboratory	Number per pound and percent	Number per pound	Number per ounce	Number in working sample	Percent given	Amount not given	Special for certain crops
Alabama		X[2]					
California		X					
Canada							X[13]
Colorado						X[10]	
Connecticut					X		
Idaho		X[2]					
Indiana						X[11]	
Iowa (State College)		X[2]					
Iowa(Dept.Agri.)				X[6]			
Kentucky						X	
Louisiana					X		
Maryland				X[7]			
Massachusetts		X[3]					
Michigan		X[2]					
Minesota						X[12]	
Mississippi		X					
Montana	X[1]						
Nebraska			X				
Nevada		X					
New Jersey				X[6]			
New York		X[4]					
North Carolina		X[2]					
North Dakota					X[9]		
Oklahoma		X					
Oregon	X						
Pennsylvania			X				
South Dakota						X	
U.S.Dept.Agri.		X[5]					
Utah		X					
Washington		X					
West Virginia			X[8]				
Wisconsin					X		

1. Those of 1% or more, others listed as present.
2. Also given in percentage for those that exceed 1%.
3. Give this information for golf course, special purposes, or to dealers who request it.
4. Percentage given when more than 0.5%.
5. Crop seed, if 1% or more give percentage and lot number. Weed seeds (large), if 5% or more give percentage and not number. Weed seeds (small), if 3% or more give percentage and not number.
6. In some cases number per pound.
7. If 1% or more in percentage.
8. Both number per ounce and percentage given.
9. Composite percentage of weed seeds and composite percentages of other crop seeds. Individual percentages given only when 1% or more, except in hard red spring wheat in which the percentage of durum is always given.
10. When a species is in large proportion, it is so stated. Total number of weed seeds per pound is also given.
11. Report percentage of crop seed if over 1%, and of weed seed if over 5%.
12. When a certain weed predominates, it is stated "considerable amount present", or "mostly". When there is considerable amount of other crop seeds, the percentage of each is given.
13. Canada, eight laboratories -

    Forage crops

    (1) Alfalfa, clovers and the larger grasses (the grasses used as forage crops - brome, timothy,etc.), weed seeds are reported by number per ounce. Other crop seeds are reported as percentage by weight. In mixtures of forage crop seeds, the noxious weed seeds are reported as number per ounce, and other weed seeds are given as percent by weight.

    (2) In the case of turf grasses, the noxious weed seeds are reported as so many per ounce, and other weed seeds as per cent by weight.

    Cereal Crops - Both weed seeds and other seeds each given as number per pound of seed.

TABLE 3. - METHODS OF REPORTING WEED SEEDS (OTHER THAN NOXIOUS), AND OTHER CROP SEEDS - NOT LISTED SEPARATELY.

Laboratory	Total Percentages for Each Group Stated Separately	Total Percentage for Both Groups Stated Collectively as "Foreign Seed"	Percentage Not Stated but Pure Seed Given
Arizona		X	
Arkansas	X[1]		
Delaware	X		
Illinois	X		
Kansas	X		
Maine	X		
Missouri	X[2]		
New Hampshire	X		
New Mexico	X		
Ohio	X		
Rhode Island	X		
South Carolina			X
Tennessee	X		
Texas	X		
Vermont			X
Virginia	X[3]		
Wyoming		X	

1. In a blank space is shown percentages of rather large amounts of weed seeds and other crop seeds.
2. Entire percentage of crop seeds, and note gives each kind if 1% or over. Entire percentage of weed seeds, with explanation in note if significant.
3. When either is high, it is stated thus: "The weed seeds or crop seeds consist chiefly of %.

As shown in Table 2, the individual species of weed seeds and other crop seeds are listed in the reports of 39 laboratories while as shown in Table 3, 17 laboratories do not give these details. All laboratories do, however, report the total percentages of these seeds either directly or indirectly.

Of the laboratories which list the weed seeds and other crop seeds, only two give both the number per pound of seed and the percentage of each, 14 laboratories give only the number per pound of seed of each, three give the number of each per ounce of seed, three give the number as found in the working sample as analyzed, four give the percentage of each, while five do not specify the amount of each kind of such seeds. The Canadian laboratories report these weed seeds and other crop seeds differently for the grasses and clovers than for the cereals. For grasses and clovers, the individual weed seeds and the other crop seeds are stated in terms of number per ounce of seed, while other crop seeds are reported as percentage by weight. The same is true for mixtures of forage crop seeds. For the cereal crops, both weed seeds and other crop seeds are stated in number per pound of seed.

The 17 laboratories which do not list the individual weed seeds and other crop seeds in their reports, are shown in Table 3. Thirteen of these laboratories report the total percentages of the weed seeds and the crop seeds separately. Two laboratories report the total percentage of them collectively as "foreign seed", while the other two laboratories do not report the amounts of the weed seeds and other crop seeds as such, but do give the percentage of pure seed.

It would seem from a consideration of these methods of reporting weed seeds

and other crop seeds that some laboratories are giving more detail than is necessary while others are not supplying enough information. It is apparent that the listing of the individual kinds of weed seeds and other crop seeds is of value to the owner of the seed and that some information as to the amount of each should be given. The suggestion is made that the actual amounts of the individual seeds be given only when they exceed a certain amount. This amount is tentatively set at 1.0%. This would mean that all seeds found would be listed and that the amount of each of those which, in the judgment of the analyst, were present to the extent of 1.0% or more would be given, while the other seeds would be grouped under the statement, "Present in amounts of less than 1.0%". It is possible that this figure might well be raised to 2% or more.

Summary

This survey of the methods of reporting results by the various official seed testing laboratories in the United States and Canada furnishes the following items of interest:

1. Seven items of information are usually furnished on a seed test report.
2. Separate sheets are used by 15 laboratories for reporting purity and germination results.
3. Facsimile of seed label is used by 18 laboratories as part of report.
4. "Actual Value" of seed is given by 17 laboratories as part of their reports.
5. Individual species of weed seeds and other crop seeds found in test sample are listed by 39 laboratories, while 17 laboratories do not give such details.
6. Two laboratories give both number per pound of seed and percentage of each kind of weed seed and other crop seed, 14 give number per pound only, three give number per ounce, four give percentage, while five do not specify amounts of each kind.

Recommendations

The following recommendations relative to the form of report are made:

1. It is desirable to list the individual kinds of weeds seeds (other than noxious) and the individual kinds of crop seeds found in the test sample.
2. The amounts of the individual weed seeds and other crop seeds should be indicated. To simplify the work of the analyst, it is suggested that the actual amounts of the individual seeds be given only when they amount to 1.0% or more and that other seeds be listed and grouped under the statement, "Present in amounts of less than 1.0%."
3. Actual value means much in the interpretation of the results of the test of a seed stock and should appear on all reports where both purity and germination are given.
4. The use of a facsimile of the seed label as a major part of a report means much in the usefulness of the report and it is recommended that it be used more generally.

COMPARISON OF TIME REQUIRED FOR COMPLETE AND MODIFIED ANALYSIS OF SEEDS[1]

W. O. Whitcomb

Time required for analysis of seeds is an important item in every laboratory. The work reported in this paper was undertaken for the purpose of obtaining some data relative to the time required for analysis by different methods. The committee would like to emphasize that there has been no thought of comparing time required for analysis by different workers or in different laboratories. The assistance which has been received from the various laboratories, in response to an appeal which was made in the March, 1939 issue of the NEWS LETTER, has been very helpful in this study and has contributed much to the completeness of the work.

Time Required in Relation to Information Furnished

It is apparent that not all of the detailed information, which is sometimes furnished as a result of a complete analysis, is made use of by the owner of the seed. Special reference is made to small percentages or traces of a number of foreign seeds. Such details frequently receive but a passing glance by the buyer of such seed. A list of seeds bracketed with a statement that they are present in amounts of less than 1.0% would mean just as much.

In this connection the committee would like to quote a statement received from the Virginia Laboratory: "It might be well to point out that it is desirable for any laboratory to have two methods of testing: (1) Complete analysis to be made when necessary, (2) partial analysis to be made when such would give the required information. This more practical form of seed testing has enabled this laboratory to test more samples with the same force, and, probably still more important, to report the results in time to aid the farmers and dealers in buying and selling. Also, in the case of official samples, it makes it possible for us to sieze lots almost immediately upon receipt of the sample."

Time Required in Routine Analysis

In 1935, Mrs. Crouley[2] of the Minnesota Laboratory presented some data on the time required in the routine analysis of sweet clover seed. It was shown that the time varied from 10 to 45 minutes per sample and that the percentage of pure seed in the sample had a direct relationship to the time; the higher the purity, the less the time required.

In the present study, three laboratories have provided data for time required for analysis. While direct comparisons cannot be made between these results because of the varying conditions under which they are made, this sort of information should be of interest to analysts.

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1. Contribution from the Montana State College Agricultural Experiment Station. Paper No. 138, Journal Series.
2. Crouley, Ruby Use. Time required for analyzing sweet clover samples. Proc. Assoc. Official Seed Analysts North America. 1935: 50-51. 1936.

Sacksville, Canada.- As shown in Table 1, the time required for analysis of a wide range of kinds of seeds was from 12 minutes for vegetable and root crop seeds to 25 minutes for cereals and 120 minutes for clovers. Forage crop mixtures required something like 150 minutes while lawn grass mixtures required as much as 480 minutes.

Idaho.- The work reported from Idaho is for five kinds of seeds. Red clover, strawberry clover, and alfalfa required from 23 to 29 minutes, while blue grass required as much as 133 minutes.

Montana.- Two forms of analysis are reported from Montana. The complete analysis was used for the submitted samples while a modified analysis was used for the samples obtained in the seed inspection work. The size of working sample in both cases was that prescribed in Rules and Recommendations for Seed Testing.

As shown in Table 3, the work was done on 25 kinds or conditions of seeds for the submitted samples. The time required for complete analysis ranged from 20 minutes for spelts to as much as 205 minutes for redtop. The time for cereals (wheat, 28; barley, 24; and oats 26) compares favorably with that reported from Sackville for all cereals, which is 25 minutes. The time required for alfalfa in Montana and Idaho laboratories compares favorably, being 33 and 28 minutes, respectively.

In the seed inspection work in Montana, in which the modified method of analysis was used, 25 kinds of seeds were analyzed. The time, as shown in Table 4, ranged from 10 minutes for soy beans and 27 mintues for alfalfa to 96 minutes for bluegrass and 160 minutes for orchard grass.

A comparison of time required for complete analysis, as shown in Table 3 and for modified analysis in Table 4, both of which are for Montana, is of interest. A few typical cases are cited: Alfalfa, 33 and 27; red clover, 35 and 33; sweet clover, 27 and 24; oats, 26 and 20; barley, 24 and 15; bluegrass, 72 and 75; brome grass, 44 and 64; meadow fescue, 43 and 50; crested wheat grass, 63 and 56; and timothy, 29 and 21. The most outstanding exception is orchard grass which was 95 minutes for seed averaging 88.6% purity for the complete analysis as compared with 160 minutes for seed averaging 86.3% purity for the modified analysis.

Special Study of Time Required by Complete and Modified Analysis

As contrasted with the above data on time required for routine analysis, the committee made a special study of time required for complete and modified analysis. This work was done in four laboratories on a variety of seeds.

Nebraska.- As shown in Table 5, six kinds of seeds were studied and the percentage of time saved by the modified method of analysis was computed for each. The time saved ranged from 3% for brome grass to 25% for sweet clover.

Minnesota.- The data given in Table 6 for Minnesota shows a saving of time

for the modified method amounting to 20% for millet, 27% for alfalfa and red clover, 29% for timothy, 38% for sweet clover, and 39% for alsike clover.

Virginia.- In Table 7, a comparison is made of the time required for complete and modified analysis of 18 kinds of seeds. The time saved by the modified method ranged from 31% for orchard grass to 33% for seven other kinds and 67% for five others.

Montana.- Two analysts made a special study of the time required to analyze alfalfa, red clover, and sweet clover, each working on different lots. As shown in Table 8, the samples had a wide range in percentage of purity and in the number of kinds of weed seeds and crop seeds present. Analyst A, who worked on seven samples, found a saving in time in favor of the modified analysis ranging from 8% for alfalfa to 57% for sweet clover. The time saved by analyst B on six samples, ranged from 13% for alfalfa to 38% for red clover.

Relation of Purity of Seed to Time Saved by Modified Method

Since the difference between the complete and modified methods of analysis lies in the different methods of handling and reporting the weed seeds and other crop seeds, it is fair to expect that the percentage of pure seed and the number of kinds of foreign seeds will have a direct bearing on the difference in time required by the two methods.

First, let it be noted how the purity of the seed affects the time for analysis in routine work when the complete method is employed. In Table 3, the time required for routine analysis of seven kinds of seeds is given in three ways: (1) average of all samples, (2) average for low purity samples, and (3) average for high purity samples. In the case of each kind of seed, the time required for the low purity samples was highest, that for the high purity was lowest, while that for the average of all samples was intermediate between the two. The averages for the seven kinds of seeds were: low purity, 45 minutes; high purity, 26 minutes; and average of all, 32 minutes.

When the percentage of pure seed is correlated with the time saved by the modified method of analysis, a somewhat different condition than that above noted is found. As shown in Table 8, sample No. 6 of sweet clover which had a purity of 98.8%, showed a saving of 57% in time in favor of the modified method, while sample No. 1 of alfalfa with a purity of 65.7% showed a saving of but 28% in time. The real difference in these two samples is found in the number of kinds of weed seeds and other crop seeds; No. 1 had 19 kinds of weed seeds and 6 kinds of other crop seeds, while No. 6 had 9 kinds of weed seeds and 2 kinds of other crop seeds.

Conclusion

It is believed that the data presented in this report warrant the conclusion that the use of the modified method of analysis of many kinds of seeds will effect a saving of time which will be significant and at the same time will provide the desired information in most cases.

Table 1. - Sackville, Canada - Time Required for Analysis

Kind of seed	Quantities analyzed, ounces unless otherwise stated.	Time required for complete analysis[1]
		Min.
Cereals	8 plus 8	25
Vegetable seeds and root crops	1/2 plus 1/2 plus 1/2 1 plus 1 plus 2	12
Brassica sp.	1/2 plus 1/2 plus 1/2	30
Mangel	8 plus 8	30
Clovers (except white and alsike)	1/2 plus 1/2 plus 1	120
White and alsike clover	1/4 plus 1/4 plus 1/2	150
Forage crop mixtures	1/4 plus 1/4 plus 1/2 1/2 plus 1/2 plus 1	150
Timothy	1/4 plus 1/4 plus 1/2	45
Agrostis spp., one sp. only	1/16 plus 1/16 1/8 plus 1/8	120
Agrostis spp., one sp. only	(Pure Seed) 1/2 gram plue 1/2 gram	90 [2]
Agrostis spp., more than one sp. present	Identification of percentage of each species present	180
Lawn grass mixture	1/8 plus 1/8	480

1. Based on an average of a large number of samples, but it is only an approximation, as much depends upon experience of analysts and quality of the seed. Another factor which should be considered is that the quantities analyzed are larger than those commonly used.
2. Time long, due to inefficient blower.

Table 2. - Idaho - Time Required for Modified Analysis

Kind of Seed	Number of samples studied	Average purity	Time required for complete analysis and grading as indicated [1]
		%	Min.
Red Clover	5	98.2	23 [2]
Strawberry Clover	1	97.0	29
Mixture	1	99.6	17
Alfalfa	2	99.0	28 [2]
Kentucky Bluegrass	5	87.4	133

1. Complete analysis: Weed seeds not listed but crop seeds listed and number per pound of each kind given.
2. Graded, others not graded.

Table 3. - Montana - Time Required for Complete Analysis of Various Kinds of Seeds at Montana Seed Laboratory, Influence of Purity of Seed on Time. [1]

Kind of seed, and number of samples	Average of all samples		Average for low purity samples		Average for high purity samples	
	Purity	Time	Purity	Time	Purity	Time
	%	Min.	%	Min.	%	Min.
Red Clover - 50	95.4	35	93.5	57	98.4	30
Sweet Clover - 136	90.6	27	93.2	39	98.4	24
Wheat - 194	94.6	28	91.1	39	97.4	23
Barley - 35	94.9	24	92.4	26	97.6	22
Millet - 57	95.9	38	91.6	59	97.3	27
Alfalfa - 305	97.0	33	90.4	57	97.4	32
Flax - 50	91.7	37	88.0	40	97.0	25
Oats - 50	97.7	26				
Sudan Grass - 8	97.8	38				
Western Wheat Grass-7	91.8	67				
Redtop - 3	93.5	205				
Uncleaned seed - 3	72.4	155				
Orchard grass - 2	88.6	95				
Brome grass - 6	93.2	44				
Spelt - 2	93.2	20				
Meadow fescue - 3	96.6	43				
Rye - 8	94.3	36				
Timothy - 16	98.0	29				
Sorghum - 27	93.2	25				
Blue grass - 6	89.9	72				
Alsike clover - 7	92.9	49				
White clover - 5	98.6	38				
Mixtures - 72	96.0	84				
Crested Wheat grass-41	89.7	63				
Screenings - 14	55.1	128				

1. Complete analysis: Listed all weed seeds and crop seeds and gave number of each per pound of seed, and percentage.

Table 4. - Montana - Time Required for Modified Analysis of Seed Inspection Samples [1]

Kind of seed	Number of samples	Average purity	Average time required per sample
		%	Min.
Alfalfa	108	94.0	27
Sweet clover	80	97.7	24
Red clover	20	97.0	33
Alsike clover	27	98.3	21
Crested wheat grass	22	88.9	56
Millet	36	97.5	23
Timothy	25	99.3	21
Orchard grass	5	86.3	160
Blue grass	11	89.8	75
Sorghum	11	97.2	27
Brome grass	15	91.3	64
Sudan grass	13	98.6	25
Flax	8	98.0	26
Rye	4	94.0	26
Barley	2	95.2	15
Oats	4	96.9	20
Redtop	5	98.0	23
Meadow fescue	7	94.2	50
Western wheat grass	1	86.2	40
Lespedeza	1	99.0	30
Rye grass	1	99.8	20
Soy beans	1	97.2	10
Spelt	1	97.0	15
Reed canary grass	1	99.0	15
Mixed seeds	10	97.6	56

1. Analysis: Pure seed %, total other crop seed %, total weed seeds %, noxious weed seeds number per pound, and inert matter %.

Table 5. - Nebraska - Comparison of Time Required for Complete and Modified Analysis

Kind of seed	Number samples Studied	Time required		Time saved	
		Complete [1]	Modified [2]	Modified	Modified
		Min.	Min.	Min.	%
Alfalfa	7	19	15	4	21
Sweet Clover	4	20	15	5	25
Brome grass	1	32	31	1	3
Millet	2	11	10	1	9
Sudan grass	3	24	21	3	13
Sorghums	4	11	10	1	9

1. Complete analysis: All weed seeds and crop seeds listed and number per ounce of seed for each given. Statement as to damage or disease.
2. Modified analysis: Weed seeds and crop seeds not listed, but total percentages of each given.

Table 6. - Minnesota - Comparison of Time Required for Complete and Modified Analysis

Kind of seed	Number samples studied	Average purity	Time required		Time saved	
			Complete [1]	Modified [2]	Modified	Modified
		%	Min.	Min.	Min.	%
Alfalfa	5	92.2	41	30	11	27
Alsike clover	5	85.4	67	41	26	39
Red clover	5	96.5	37	27	10	27
Sweet clover	5	94.8	34	21	13	38
Millet	5	94.3	30	24	6	20
Timothy	4	95.2	52	37	15	29

1. Complete analysis: All weed seeds and crop seeds listed and percentage of each given.
2. Modified analysis: Weed seeds and crop seeds not listed, but total percentages of each given.
The balance of the sample was examined for noxious weed seeds in each case, and this time was included.

Table 7. - Virginia - Time Required for Complete and Modified Analysis

Kind of seed	Time required for analysis- minutes [1]		Time saved	
	Complete	Modified	Modified	Modified
			Min.	%
Korean lespedeza	75	30	45	60
Red clover	75	30	45	60
Alfalfa	60	20	40	67
Sweet clover	60	20	40	67
Crimson clover	60	20	40	67
Alsike clover	60	20	40	67
Timothy	60	20	40	67
Redtop	165	75	90	55
Kentucky bluegrass	105	60	45	43
Orchard grass	195	135	60	31
Oats	90	60	30	33
Wheat	45	30	15	33
Barley	45	30	15	33
Rye	90	45	45	50
Sorghum	45	30	15	33
Rape	30	20	10	33
Millet	45	30	15	33
Rye grass	90	60	30	33

1. Work done by three senior analysts. The minutes given are approximations, but they are believed to be fairly accurate. This time does not include varietal work.

Table 8. - Montana - Comparison of Time Required for Complete and Modified Analysis of Seeds - Results by Two Analysts on Different Samples.

Sample Number Kind	Pure seed	Total weed seeds[1]	Total crop seeds[2]	Time required		Time saved	
				Complete[3]	Modified[4]	By modified	
	%	%	%	Min.	Min.	Min.	%
ANALYST A							
1. Alfalfa	65.7	7.7	5.9	130	94	36	28
2. Alfalfa	98.4	.6	.6	25	23	2	8
3. Alfalfa	94.6	.8	trace	25	16	9	36
4. Alfalfa	91.3	1.6	1.7	45	29	16	36
5. Red clover	98.9	.5	trace	20	13	7	35
6. Sweet clover	98.6	.4	.4	35	15	20	57
7. Alfalfa	98.4	.2	1.2	39	32	7	18
ANALYST B							
8. Alfalfa	75.4	20.6	.2	75	56	19	25
9. Red clover	96.6	1.0	1.6	40	25	15	38
10.Alfalfa	99.3	.1	0.0	15	13	2	13
11.Sweet clover	75.4	14.6	.1	105	69	26	25
12.Alfalfa	94.2	2.2	2.4	30	22	8	27
13.Alfalfa	99.4	.4	.1	15	11	4	27

1. Number of kinds of weed seeds found in each sample: No. 1, 19 kinds; No. 2, 3 kinds; No. 3, 6 kinds; No. 4, 8 kinds; No. 5, 6 kinds; No. 6, 9 kinds; No. 7, 3 kinds; No. 8, 5 kinds; No. 9, 4 kinds; No. 10, 3 kinds; No. 11, 6 kinds; No. 12, 8 kinds and No. 13, 4 kinds.
2. Number of kinds of other crop seeds found in each sample: No. 1, 6 kinds, No. 2, 1 kind; No. 3, 1 kind; No. 4, 1 kind; No. 5, 1 kind; No. 6, 2 kinds; No. 7, 1 kind; No. 8, 1 kind; No. 9, 3 kinds; No. 10, 2 kinds; No.11, 2 kinds; No.12, 1 kind; and No. 13, 2 kinds.
3. Complete analysis: Listed, counted, and weighed each kind of weed seeds and crop seeds and computed number per pound of seed and percentage of each.
4. Modified analysis: Listed, counted, and weighed each kind of weed seeds and crop seeds, but weighed and counted only those kinds which amounted to 1.0% or more. Others were grouped as being present in amounts of less than 1.0%.

REPORT OF PUBLIC SERVICE COMMITTEE

Sometime during the Autumn of 1938 the Public Service Committee was requested, by a member of the Association, to investigate the advisability of the Association sponsoring a National Seed Week for North America. The thought is to lay out a program for better seed publicity to be carried out simultaneously and cooperatively over the whole area by the experiment stations, state departments of agriculture, state extension services, seed trade publications, seedsmen, radio, farm bureau federations, U. S. D. A. extension services, farm union, seed councils and other allied organizations.

Various kinds of "weeks" have been emphasized by certain organizations, hence the idea is not new, but one which has been tried with varying degrees of success and one perhaps worthy of trial by our Association. Consequently your committee has gathered opinions and suggestions for carrying out such an idea in Canada and the United States and presents the following thoughts and questions for your elaboration and advice.

Opinions of the advisability of launching such a project from those in favor are largely in the majority. It is agreed that the organization of material for such a campaign would involve an enormous amount of work on the part of the Public Service Committee in consequence of which it is advised that publicity should be organized and conducted within each state by the State Department of Agriculture or the Seed Laboratory. Those who oppose the idea claim that "weeks are effective in publicizing an article for the time only; that it would only be effective if followed up by a continued publicity program. This is the experience of those who have underwritten other "weeks", which are now said to be so common that they have lost the appeal of novelty and general interest of the public.

Then there is the matter of choosing the ideal time for general publicity for such a program. The trade journals believe that a time of the year should be selected when most of the farmers and home gardeners are interested in planting. In other words, January or February would be a poor choice, but March or some time in April would be more ideal. It would be difficult to select a week which might be satisfactory for every part of the whole area considered, but March or April would take care of the major sections.

Secretary Wallace challenged us to put our services before the public in such a way that they will be of great value to it in emphasizing the use of much better seed. The Better Seed Week plan seems to us one means of accepting this challenge. The success of such a plan, however, involves extensive cooperation and such a huge amount of work that your committee has not the courage to undertake it without your advice and acceptance of the idea. Does the Association, as a whole, think the movement advisable? Should a seed week be general for the United States and Canada or should it be sectional and at varied times? What tentative dates are suggested?

These are a few of the questions which must be answered. The Public Service Committee awaits your advice. - F. A. McLaughlin, Chairman.

REPORT OF HISTORY COMMITTEE

Your committee is aware that the annual meeting of this Association in 1937 authorized the completion of compilation of the history of the association and authorized the committee to obtain bids on its publication before the 1938 meeting.

For various reasons work did not reach the publication stage by that time.

Most of the material which the committee has had in mind has now been assembled and compiled in the best form possible, in the time that could be devoted to it.

Three people have worked on the revisions of individual portions of it so it cannot now be said to be a master piece of literature; it could doubtless be improved if one member could rewrite the entire assemblage.

The following is a list of items now prepared or in process of preparation:

1. History of Association of Official Seed Analysts.
2. History of Seed Testing in United States now being compiled by Mr. Brown.
3. History of Seed Testing in Canada by Mr. Wright.
4. History of each State seed laboratory.
5. History of each seed laboratory in Canada.
6. A tabular form of dates in regard to early seed testing and seed laws in States.
7. A Who' Who of seed analysts - very brief.
8. A list of retired members.
9. A list of honorary members.
10. There should be a history of the Division of Seed Investigations U. S. D. A. and its predecessor, the Seed Laboratory.
11. There should also be an article on the influence of the laboratory of U. S. D. A. in development of the Association. -

Anna M. Lute, Chairman.

REPORT OF THE EDITOR OF NEWS LETTER

The editing of the News Letter during the past Association year has been as great a pleasure as a responsibility. The able assistance of Dr. G. P. Steinbauer, especially in the abstracting of literature pertinent to seed testing relieved the editor of considerable work and brought several valuable papers to the attention of the readers.

It should be realized that the successful editing and distribution of the News Letter can not be accomplished by one person alone. A small editorial committee such as existed this year possesses certain advantages which make its continuance preferable to a return to a single editor or to the creation of a larger, cumbersome committee. Although cooperation with other members of the proposed "Editorial Committee" is desirable doubtless a certain degree of

independence should be extended to the editors of the News Letter.

The mailing list of the News Letter was altered somewhat to economize in distribution costs. The practice of supplying copies for the personal use of a single analyst was discontinued. It is hoped that every analyst in the member laboratories has had access to each issue even though copies were mailed directly to the laboratory rather than to an individual in the laboratory. Usually complaints that the News Letter was not received were traced to a lack of cooperation among members in the laboratory concerned.

The value of the News Letter depends entirely upon the number and excellence of the contributions. In reviewing the various issues of the past year it appears that several papers of unquestionable scientific value have been reproduced. To those, both commercial and official analysts, who supplied technical and personal items the editor extends his thanks. Those who did not find time to prepare papers or notes will find their contributions very welcome during the coming year. It should be realized that the editor can not guess what is happening in each laboratory nor has he the time or ability to prepare innumberable technical articles.

The officers and committee chairmen have whole-heartedly cooperated in presenting the business matters of the Association. Dr. C. W. Leggatt supplied many news articles for which he neither expected nor received due credit. The entire membership of the Geneva laboratory cheerfully assisted in assembling papers and in the performance of menial tasks involved in the preparation of each issue. To all these the association owes an expression of thanks. -

Willard Crosier, Editor

REPORT OF THE PUBLICATIONS COMMITTEE

The work of the Publications Committee for the year has had to do with the following subjects:

1. Completing the publication of the index of the Proceedings, which was outlined in the last report of this committee.
2. Obtaining information relative to the availability of reports and papers which were presented at meetings prior to 1914 at which time the first Proceedings were published.
3. Assembling the papers and reports of the 1938 meeting and publishing the Proceedings for that year.

Index of Proceedings. - The index of the published proceedings of the first 29 meetings of this Association was published and distributed in February, 1939. This publication consists of 34 pages and was planographed by the A. L. Sauls Planograph Co., Washington, D. C., at a cost of $78.00 for 500 copies, or approximately 16 cents per copy.

Availability of Papers Presented Prior to 1914. - Following the suggestion of J. P. Helyar relative to the assembling of papers and reports which were presented at the first few meetings of the Association, an attempt was made to complete the records of these early years. Miss Jessie G. Fiske of New Jersey

lent her assistance and contacted Mr. Helyar. He advised that he had delivered all records to W. L. Oswald who succeeded him as secretary. Correspondence with Mr. Oswald and Mr. Stone, who were succeeding secretaries, revealed the fact that no unpublished papers or reports were available.

Proceedings of 1938 Meeting. - The material for the 1938 meeting was assembled and edited following the meeting in Guelph last year. This work consumed considerable time as a number of members failed to furnish the secretary with typewritten copies of their papers and some of the papers required abstracting before publishing.

The edited material was submitted to the A. L. Sauls Planograph Co. in April and the proof sheets were read by the committee and returned to them the last of May. The published Proceedings are being distributed at this meeting. This volume consists of 280 pages and the cost of planographing was $728.00.

Care in Preparation of Papers. - The committee would like to emphasize the importance of more care on the part of authors of papers in the preparation of such papers. Material which has been published, or which is soon to be published elsewhere, should not appear in these Proceedings except perhaps in abstract form. It should also be borne in mind that papers should be as short as is consistent with the proper presentation of the subject in hand. Tables should be short and the number limited.

Index of the News Letter. - It is recommended that an index of the News Letter, similar to that which has been published for the Proceedings, be published. This might well be in mimeographed form and of the same size of page as the News Letter. -

W. O. Whitcomb, Chairman

REPORT OF COMMITTEE ON INTERNATIONAL SEED TESTING CONGRESS

The International Seed Testing Association at its eighth meeting in Zurich, Switzerland, in 1937, decided to hold its ninth meeting in 1940 in Washington, D. C. As this is the first time the International Seed Testing Association will meet on this side of the Atlantic, it seems fitting that we should do everything possible to make the meeting a success, and by way of an excursion to show them as much as possible of the seed testing facilities of Canada and of the United States, as well as of North American agriculture in general.

H. J. Res. 567, approved by the President of the United States on April 8, 1938, authorizes the President to officially invite the Association to meet in the United States and to invite the various countries to send official delegates. H. J. Res. 567 also provides $500 for official entertainment of the delegates.

The following suggestions are offered on behalf of the Organizing Committee:

1. That the Association of Official Seed Analysts of North America hold its 1940 meeting in Washington, D. C., at the time of the meeting of the International Seed Testing Association.

2. That there be no program meeting of this Association, and that a limited number of papers be offered for presentation to the International Seed Testing Association by members of this Association.

3. That this Association recommend persons to serve as official delegates on behalf of this Association.

4. That this Association, through its member laboratories , render assistance in every way possible toward an informing excursion for the delegates, to be made just preceeding or immediately following the meeting of the International Seed Testing Association. - E. Brown, Chairman.

(Because of unsettled world conditions, the Ninth International Seed Testing Congress has been indefinitely postponed. - Eds.)

REPORT OF RESEARCH COMMITTEE

1938-1939

The work of the Research Committee was continued on the same lines as during the previous year, with much the same personel and extended somewhat, to include studies with other kinds of small seeds in addition to bluegrass. Mr. Bass was re-appointed chairman of Region No. 5 for a further period of 5 years.

The personel of the Research Committee is as follows, the retiring dates being given in the case of the regional chairmen:

Region No. 1	W. O. Whitcomb	1939
Region No. 2	R. H. Porter	1941
Region No. 3	C. W. Leggatt	1940
Region No. 4	W. L. Goss	1942
Region No. 5	C. M. Bass	1943

Sub-committees:

Techniques for Analysis of Small Seeds	- R. H. Porter
Analysis of Brome grass Seed	- Edith C. Higgins
Viability of Injured Weed Seeds	- C. M. Bass
Viability of Hard Seeds	- W. O. Whitcomb
Sand as a Substratum for Germination Tests	- C. W. Leggatt
Seed Sanitation	- W. F. Crosier
Revision of Rules	- E. H. Toole
Handbook	- E. Brown

The reports of the Regional Chairmen are presented first, followed by those of the sub-committee chairmen, in order.

Report for Region No. 1

W. O. Whitcomb

Ten laboratories in Region No. 1 took an active part in the referee testing. Two other laboratories expressed an interest in the work, but were unable to take part because of routine work and limited staff.

Inert matter and its determination as it influenced the percentages of purity and germination of the various kinds of seeds, was given special consideration.

Material.- The kinds of seeds which were studied together with some of their characteristics are listed as follows:

1. Alfalfa - low germination and high percentage of weak and broken sprouts. Average pure seed was 98.33%, inert matter 1.52%, germination 61%, weak and broken sprouts 25%, and hard seeds 10%.

2. Alfalfa - Low germination and a rather high percentage of broken sprouts and hard seeds. Average pure seed was 94.96%, inert matter 4.15%, germination 52%, weak and broken sprouts 23%, and hard seeds 22%.

3. Crested Wheat Grass - The pure seed averaged 84.57%, the inert matter 15.33%, the germination 81%, and dead seed 17%. This sample was furnished by a jobber who was not satisfied with the variable results of tests which he had obtained from several official laboratories.

4. Reed Canary Grass - This was a nice appearing seed furnished by an analyst of a wholesale house. The pure seed averaged 96.51%, inert matter 2.72%, germination 76% and dead seed 20%.

5. Red Clover - Injured by chalcis fly. Average pure seed was 97.45%, inert matter 1.63%, germination 83%, weak and broken sprouts 4%, and hard seeds 11%.

6. Field Peas - There was a rather high percentage of split and broken seeds. Average pure seed was 95.50%, inert matter 4.48%, germination 80% and dead seed 14%.

7. Red Clover - This seed was injured by chalcis fly. Average pure seed was 94.12%, inert matter 3.94%, germination 83%, weak and broken sprouts 5%, and hard seeds 8%.

8. White clover - This seed was injured by clover weevil. Average pure seed was 97.72%, inert matter 1.65%, germination 81%, weak and broken sprouts 3%, dead seeds 5%, hard seeds 11%.

Preliminary Reports. - Preliminary summaries of results of tests were distributed to the various laboratories as soon as a sufficient number of reports were in. The comments which were received relative to these results were very interesting and showed that the analysts were deriving much benefit from the comparative results of other analysts. Complete tabulated results of tests have recently been sent to each analyst who participated.

Pure seed as Influenced by Inert Matter. - As the lots of seed under consideration were rather free from weed seeds and other crop seeds, there was a close negative correlation between pure seed and inert matter as determined by the various analysts. This held true for all of the different kinds of seeds even though the inert matter varied considerably in the various lots.

When the viable seeds found in the inert matter are taken into consideration as suggested by Porter[1] in which he added one-half weight of a normal seed to the pure seed for each normal sprout obtained in the inert matter, an even better correlation between pure seed and inert matter is obtained. This is illustrated by the report of laboratory No. 5 for sample No. 1 of alfalfa. When the purity of 96.82% is increased by half the weight of the 30 normal sprouts in the inert matter, the purity is raised to 97.39%, which is in line with some of the other purities in which but few strong sprouts were obtained in the germination of the inert matter.

Germination as Influenced by Inert Matter. - A study of the germination as determined by the various analysts in relation to the percentage of inert matter as determined by them did not show the correlation that one might expect. In the case of the two lots of alfalfa, the inert matter ranged from 0.76% to 8.48% and the germination from 43% to 68%, yet there was no consistent correlation between the two. The weak and broken sprouts in the alfalfa ranged from 9% to 32%. When these were correlated with the inert matter, it was found that there was a better agreement than in the case of the germination but there were still several discrepancies.

The inert matter in the one lot of crested wheat grass ranged from 12.47% to 19.59% and the germination from 72% to 88%. The lack of correlation between these two factors is shown by the following comparisons: 19.59% inert matter had 78% germination, 12.47% had 85, and 15.25% had 88% germination. The weak and broken sprouts in the crested wheat grass ranged from 0% to 8%, but there was not a very consistent relationship between these and the inert matter.

Much the same lack of agreement between inert matter on reed canary grass and each of the factors of germination and weak and broken sprouts was found as in the case of crested wheat grass.

The two lots of red clover on which there were 18 tests made showed a range in inert matter from 0.35% to 6.10% and in germination from 76% to 87%. A study of the correlation of these two factors shows a lack of a consistent relationship much the same as in the alfalfa and grasses previously mentioned.

The best agreement between inert matter and each of the factors of germination and weak and broken sprouts was found in the white clover. The range in inert matter was from 0.91% to 2.65%, in germination from 75% to 88%, and in weak and broken sprouts from 1% to 8%. The two analysts who reported 0.91% and 0.94% inert matter, respectively, reported 76% and 75% germination, while those who reported 2.65% and 2.30% inert matter both reported 80% germination.

Germination of Inert Matter.- As a measure of the accuracy of separating out inert matter from the various kinds of seeds, each analysts was requested to germinate the inert matter and report the number of strong and weak and broken

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1. Porter, R.H. Report of the Research Committee. Proc. Assn. Off. Seed Analysts North America. 1936: 13-17. 1936.

sprouts from that obtained from certain given amounts of seed. These results were varied and proved of special interest to the analysts who did the work.

In the two lots of alfalfa seed, on which there were 20 tests made, the strong sprouts ranged from 0 to 90 in the inert matter which came from 10 grams of seed, while the weak and broken sprouts ranged from 30 to 229 from the same separations of inert matter. The analysts who reported no strong sprouts and but 4 weak and broken ones recorded 0.81% inert matter, while the one who reported 90 strong sprouts and 106 weak and broken ones recorded 5.74% inert matter. The analyst who reported 229 weak and broken sprouts also reported 87 strong sprouts and recorded 8.48% inert matter.

The inert matter from 10 grams of the crested wheat grass, when germinated, showed a range of strong sprouts from 0 to 8 and of weak and broken sprouts from 0 to 3. The analyst who reported 8 strong sprouts in the inert matter recorded 16.22% of inert matter, while the one who reported 0 strong sprouts recorded 14.00% inert matter.

The inert matter from 10 grams of reed canary grass, when germinated, showed a range of strong sprouts from 0 to 21 and of weak sprouts from 0 to 9. There appeared to be but little relationship between the number of strong sprouts and the percentage of inert matter removed.

Conclusion - This brief summary of this study of the relationship of inert matter in seed to the interpretation of the plant producing value of such seed, merely emphasizes the importance of the proper identification of such inert matter in seed analytical work. To the individual analysts who participated in the study of these 8 lots of seed and who have received tabulations of detailed data showing how their results agree with those of other analysts, this work means much more than it is possible to convey in a report of this kind.

Report for Region No. 2

R. H. Porter

The work of the Research Committee as applied to Region No. 2 for 1938-39 was confined to (1) further studies with bluegrass seed as to methods of making purity and germination tests, (2) purity and germination technique with reed canary grass, (3) purity and germination of low grade alfalfa seed and (4) comparative tests for purity and germination of sorghum seed.

The purpose of the tests with seed of reed canary grass and bluegrass was to (1) compare the official method of making purity analyses with the modified uniform method and (2) determine if more uniform pure seed fractions would result in greater uniformity in germination tests.

The alfalfa referee test was designed to determine if uniform pure seed fractions would correct some of the extreme differences encountered in germination tests and further to study the value of sand in measuring normal seedlings of alfalfa.

The tests with sorghum were concerned with a comparison of sand and blotter tests for germination of sorghum seed.

The results obtained, together with a discussion of same are contained in the following pages.

Tests with Uniform Pure Seed Fractions of Bluegrass.- Eight sub-samples of bluegrass seed were tested by the uniform method of procedure. Each of the pure seed fractions was then divided into four parts labelled, a,b,c and d. All of the "d" and one "c" portions were retained by the Iowa laboratory and tested on top of sand under uniform conditions. The other 24 portions were randomized and each of 24 laboratories received one of the fractions. Tests were made on top of sand and by the method preferred by the laboratory. Twenty laboratories made the tests.

The results of the tests are shown in table 1 from which the following conclusions may be drawn:

1. The pure seed fractions were remarkably uniform as shown by tests in the Iowa Laboratory under uniform conditions.
2. Germination on top of sand gave a slightly higher mean than by the method preferred, yet the variability was greater by the sand method. Five laboratories obtained a significantly higher germination in sand and two obtained significantly higher results by their own method.
3. The differences obtained by the several laboratories using either method are much greater than should be expected. It is evident that a more uniform method of germination is needed. It is believed that as analysts become more familiar with the use of sand more uniform results may be expected.

TABLE 1. - GERMINATION OF UNIFORM PURE SEED FRACTIONS OF BLUEGRASS -1939.

Sample No.	Laboratory	Germination			Highest by Lab.
		Top sand	Own	Top sand*	
		%	%	%	%
6a	Kentucky	91.2	86.2		91.2
6b	U.S.D.A	81.3	82.3		82.3
6c	Ottawa	83.3	84.5		84.5
6d	Iowa			86.0	86.0
7a	Mass	73.8	77.8		77.8
7b	Winnipeg	84.0	83.0		84.0
7c	Illinois		82.0		82.0
7d	Iowa			85.8	85.8
8a	Indiana	83.5	78.3		83.5
8b	Michigan	87.0	89.8		89.8
8c	Minnesota	83.5	83.0		83.5
8d	Iowa			86.8	86.8
9a	Missouri	81.0	87.0		87.0
9b	Kansas	82.3	75.5		82.3
9c	Nebraska	85.3	82.0		85.3
9d	Iowa			84.0	84.0
10a	Ohio		86.5		86.5
10b	Wisconsin	80.5	81.3		81.3
10c	A. Dickinson	84.3	86.0		86.0
10d	Iowa			84.5	84.5
11a	McCullough	86.8	82.8		86.8
11d	Iowa			85.8	85.8
12a	Cornell	88.3	88.3		88.3
12b	Mangelsdorf	86.3	73.5		86.3
12c	Vaughans	85.8	85.8		85.8
12d	Iowa			84.0	84.0
13b	Ross Seed Co.	67.8	73.8		73.8
13c	Iowa			82.5	82.5
13d	Iowa			86.0	86.0
Mean		83.1	82.5	85.0	84.6
X^2				4.72	
P				.85	
Diff.in Ext.		23.4	16.3	2.8	17.4

*Simultaneous tests under uniform conditions.

Report of Referee Test with Reed Canary Grass. - In preparing the sub-samples for this study 80 grams of seed were drawn from a lot and subdivided into 40 sub-samples such that the lowest weight was 1.910 and the highest was 2.070 grams. Each sub-sample was then subjected to the same schedule of pressure and time in the Iowa air blast separator, analysis of each completed in a uniform manner and the percentages of purity, weed seed, inert and crop seed computed.

The pure seed fractions from samples 1 to 20 were labelled "a", divided equally and one half was sent to each of 20 laboratories as noted in Table 2. The other half of each was tested in the Iowa laboratory on top of moist blotters in copper trays with wicks, using 400 seeds of each pure seed fraction. The percentages of purity of these 20 sub-samples by the modified, uniform method are given in Column 2 of the table and the germination percentages for each are shown in column 3. The name of the laboratory which received one half of each pure seed fraction is given in column 4.

In columns 5 and 6 will be found the percentages of germination of these pure seed fractions as obtained by each laboratory using two methods, top of sand and its own method.

The other 20 sub-samples (21 to 40) were each recombined as they were prior to the purity test and one each was sent to the 20 laboratories as sub-sample "b". Each laboratory then made a purity test by the official method and a germination test by its own method. The percentage purity of each sub-sample (21 to 40) as obtained by the Iowa laboratory is given in column 9. The percentages of purity and germination as obtained by the respective laboratories are shown in column 10 and 11.

In column 7, the highest percentage of germination by either method in each laboratory is given for samples 1-20 which were uniform pure seed fractions. The mean of Column 7 is higher than for any other which records germination. The data are more uniform than for columns 5, 6 and 11 but less so than for column 3 where all samples were tested under uniform conditions.

The data in the table speak for themselves. The percentages of purity for the 40 sub-samples are far more uniform by the uniform method than by the official method with 20 sub-samples and the probability by the former is .25. Compare this figure with that in column 10.

The percentages of germination are more uniform in column 3 than in any other, however it is believed that the mean is below the maximum viability of the entire lot because the method used was on top of moist blotters. In general a higher average germination is obtained on top of moist sand than in copper trays but at the time the test was made there were insufficient petri dishes available. It is believed that the mean for column 7 more nearly represents the maximum viability of the entire lot.

It should be noted that when the 20 laboratories used uniform pure seed fractions for germination by either of the two methods the uniformity as a whole is much greater (lower chi-square - see columns 5, 6 and 7) than when each used its own pure seed fraction for the germination test.

This referee test indicates that uniform procedure in purity tests provides more uniform pure seed fractions than by the old official method.

TABLE 2. - SUMMARY OF REFEREE TEST WITH REED CANARY GRASS - FALL 1938.

Sample No.	Test by Iowa Lab.		Germination by other Laboratories by 2 methods				Sample No.	Purity Percent**		
	Pure	Germ.	Name of Lab.	Top sand	Own method	Highest test		Iowa Lab.	Other Lab.	Germination
	%	%		%	%	%		%	%	%
1	97.2	75.5	Illinois	77.0	77.3	77.3	21	97.2	97.1	79.0
2	97.1	77.5	Indiana	72.5	71.5	72.5	22	96.7	96.6	67.5
3	97.1	80.8	Iowa	79.2	74.3	79.2	23	96.7	96.7	76.8
4	97.4	72.0	Kansas	77.3	75.5	77.3	24	96.9	97.7	73.0
5	96.5	76.3	Michigan	84.8	84.3	84.8	25	95.9	97.2	81.8
6	97.4	75.3	Minnesota	75.8	80.0	80.0	26	97.0	96.7	74.8
7	97.0	80.5	Missouri	76.8	78.0	78.0	27	96.6	96.9	75.0
8	97.3	77.8	Nebraska	80.5	78.0	80.5	28	97.1	96.4	70.5
9	96.9	76.8	Ohio	77.0	84.5	84.5	29	96.5	97.4	80.8
10	96.5	79.3	Winnipeg	77.0	70.0	77.0	30	96.6	97.2	67.0
11	97.1	73.8	Wisconsin		79.0	79.0	31	96.6	93.1	
12	96.2	76.8	Albert Dickinson	79.0	81.0	81.0	32	96.8	97.0	82.0
13	96.5	75.5	Northrup King	78.5	79.3	79.3	33	97.0	97.1	78.8
14	97.0	76.3	McCullough	76.3	74.3	76.3	34	97.0	94.2	81.5
15	97.0	77.8	Cornell	78.8	76.8	78.8	35	96.9	97.0	79.5
16	97.4	73.5	Mangelsdorf	79.8	82.0	82.0	36	96.8	96.1	80.5
17	96.6	74.3	Massachusetts	77.0	75.3	77.0	37	96.9	97.1	81.5
18	96.7	77.5	Kentucky	82.3	81.3	82.3	38	96.4	96.2	81.5
19	96.9	78.3	U.S.D.A.	69.0	79.8	79.8	39	97.3	95.6	79.3
20	96.5	77.5	Ottawa	78.3	75.0	78.3	40	96.5	97.3	79.0
Mean	96.8*	76.4		77.5	77.9	79.2	Mean	96.8*	96.5	77.4
X^2	41.12*	21.62		53.32	66.32	35.32	X^2	41.12*	193.6	94.52
P	.25	.30		.01	.01	.01	P	.25*	.01	.01

* Applies to the test of 40 sub-samples using the modified method.
** Official Method by each laboratory.

Referee Test with Alfalfa - One of the most difficult problems with legume seeds is that of measuring the viability of low quality lots of sweet clover and alfalfa. As a beginning on the problem a lot of low grade alfalfa was taken and about 200 grams were subdivided from which 40 sub-samples each weighing about five grams were further subdivided. Twenty of these sub-samples designated as "a" were worked over as uniformly as possible in the Iowa laboratory, pure seed fractions were saved and each divided into two parts one of each of which was retained for germination in the Iowa laboratory in blotters and sand using 400 seeds in each sub-stratum. The results by both methods show remarkable uniformity and the difference in means by the two methods is hardly significant, indicating that the interpretation of normal sprouts by the two methods was comparable. The distribution of hard seeds was also within the range of natural variability.

Each of 20 laboratories received the second half of one of the 20 sub-samples labeled "a" with a request that tests be made in blotters and sand. Fifteen laboratories participated and the results are given in Table 3. The variability is much greater as shown by a larger difference in extremes than when all the samples were tested in one laboratory. There can be no doubt but that factors of environment and interpretation operated in the 15 laboratories in addition to that of normal variation. The distribution of hard seeds, however, was within the normal range, a result that is significant in that fewer chances of error exist in the interpretation of hard seeds.

Sub-samples 21 to 40 were designated as "b" and each of the 20 laboratories received one with the request that an official purity test be made, also a germination test in blotters and sand. The data obtained by 15 laboratories are shown in Table 3. Percentages of purity agree reasonably well, although the probability is just at .01. Differences in germination for sub-samples "b" are

similar to those obtained from sub-samples "a" although the distribution of hard seeds was outside the normal range which would indicate that the pure seed fractions obtained by 15 laboratories using the official method were less uniform than when all were prepared by one analyst as was done for sub-samples "a". Sand showed slight superiority over blotters as a whole in the tests in that the variability was less with sand than with blotters.

A logical conclusion from this referee test is that a more uniform method and more uniform interpretation of normal and abnormal sprouts is a goal toward which we should all strive. Sand offers some hope and analysts are urged to experiment more with its use.

Referee Test with Sorghum - Germination of sorghum has long presented certain difficulties of interpretation as to normal sprouts because of the presence on sorghum seeds of many species of fungi that cause minor or major injury.

To further compare the results of germinating sorghum seeds in different substrata and at two different temperatures (in sand) a lot of sorghum was subdivided into 20 samples by the large Boerner sampler and each of 20 laboratories were sent one sample with the request that an official purity test be made, after which the seeds were to be tested for germination by four methods as follows:

1. Between blotters - 20-30°C
2. In soil - 20-30°C
3. In sand - 20-30°C
4. In sand - 20-30°C for 24 hours, balance of time at 30-32°C in the light during the day.

The supply of seed was not sufficient for all tests to include 4 x 100 seeds. In some cases only 200 were used.

The results of the tests are shown in Table 4 in which the percentages of purity are given in the second column. The variation is too great for homogeneous lots of seed illustrating again the effect of personal judgment in seed analysis. It was considered unnecessary to complete a statistical analysis of the data because the difference in extremes is 4.8. The probability would be less than 0.01. The high percentage of purity obtained by one laboratory (97.2) may account for the low germination but in two other cases low germination cannot be accounted for on the basis of high purity.

The germination results are worthy of study in that they show wide differences as to normal and abnormal sprouts and as to firm ungerminated seeds. In the sand test at 20-30°C the difference in extremes is low, also in the other sand test the difference in extremes is not high which offers some encouragement for the use of sand. For the interpretation of normal seedlings, however, sand was no better than blotters. Soil gave by far the most variable results. There is some encouragement in that five laboratories obtained comparable results with blotters and sand.

This referee test emphasizes again the need for a more uniform method of determing purity and a more uniform procedure for the determination of viability. The results with sand in 1938 when uniform pure seed fractions were used showed that fairly uniform interpretation could be expected. Further study of purity and germination of sorghum will be continued in 1940. A study is being made of the effect of organisms and of disinfectants on sorghum seed germination. By 1940 it may be possible to initiate a different type of test for the germination of sorghum seed.

TABLE 3. - SUMMARY ALFALFA REFEREE TEST 1939.

Sample No.	Sub-sample "a" Germination: Iowa Tests Blotters N	Iowa Tests Blotters H	Iowa Tests Sand	Other Laboratories	Other Laboratories Blotters N	Other Laboratories Blotters Ab.	Other Laboratories Blotters H	Other Laboratories Sand
	%	%	%	Laboratory	%	%	%	%
1	67.0	19.7	67.5	Winn.	62.3	21.5	15.3	59.3
2	68.3	17.3	64.0	Minn.	62.7	17.7	16.3	62.7
3	66.5	21.7	68.3	Mich.	68.5	10.7	16.7	70.7
4	67.5	18.5	70.7	Ohio				
5	72.3	14.3	73.5	Ind.	64.0	13.7	12.0	61.3
6	67.8	18.3	67.0	Ill.				
7	68.5	17.0	66.7	Mo.	64.5	11.7	17.3	65.3
8	67.6	19.3	69.5	Kan.	63.0	15.3	17.0	63.0
9	72.5	17.3	66.5	Nebr.	65.3	13.3	15.7	60.7
10	71.3	13.7	68.3	N. Dak.	68.0	14.0	14.0	68.0
11	68.0	16.3	68.7	Wis.	76.2	8.2	12.0	
12	66.3	13.3	69.7	N. King	75.7	8.0	14.3	61.3
13	69.0	15.7	68.3	Alb.	61.5	9.0	18.3	68.7
				Dick.				
14	67.0	18.0	65.5	*				
15	68.7	17.7	66.7	*				
16	72.5	13.7	67.3	*				
17	66.3	18.3	67.0	Mangels	66.7	12.5	18.0	72.5
18	71.0	16.5	67.5	Corneli	66.5		15.3	71.0
19	71.7	13.5	66.5	Vaughan	60.5	16.2	17.7	61.2
20	71.5	16.5	69.0	Iowa	71.5	10.3	16.5	69.0
Mean	69.1	16.8	67.9		66.5	13.0	15.8	65.3
X^2	18.34	27.33	14.25				16.48	46.6
P	.50	.10	.80				.29	.01
Diff in Ext	6.2	6.4	6.7		15.2	13.5	6.3	13.2

Sample No.	Sub-sample "b": Official Purity	Blotters N	Blotters Ab.	Blotters H	Sand N
	%	%	%	%	%
21	97.7	63.0	20.3	13.0	61.7
22	97.9	63.7	18.0	12.7	60.0
23	98.2	65.5	7.5	20.5	64.0
24					
25	98.4	56.0	16.5	16.0	60.5
26					
27	98.5	62.0	13.7	16.5	60.0
28	97.8	59.5	16.7	14.7	60.0
29	97.9	62.3	15.7	12.3	66.0
30	97.0	63.0	16.0	13.0	60.0
31	97.7	71.0	9.0	13.5	
32	98.1	65.7	18.0	12.5	62.5
33	97.7	70.7	6.0	16.0	71.0
34					
35					
36					
37	97.5	66.0	11.7	15.0	68.5
38	97.7	64.5		11.7	64.7
39	97.7	65.5	16.5	12.0	62.2
40	97.0	70.0	13.0	13.0	65.0
	97.8	64.6	14.2	14.2	63.3
	29.75			25.28	26.64
	.01			.03	.02
	1.5	15.0	11.3	8.8	11.0

* No returns from laboratory.

TABLE 4. - SUMMARY OF SORGHUM REFEREE TEST

Laboratory	Purity	Germination								
		Blotters			Soil		Sand 20-30°C		Sand 20-30° 24 h. B. 30-32°C	
		N	Ab.	Firm Unger.	N	Ab.	N	Ab.	N.	Ab.
	%	%	%	%	%	%	%	%	%	%
Indiana	94.2	65.0	18.2	7.2	47.0	11.0	57.2	4.2		
Iowa	92.7	74.0	6.0	3.0	70.0	3.0	74.0	2.0	75.0	3.0
Kansas	93.3	71.5	7.5	0.5	62.5	6.0	59.8	6.2	62.5	4.0
Michigan	93.9	73.0	8.0	1.0	31.8	7.5				
Minnesota	92.9	66.0	12.0		61.0	14.5	66.5	3.0	66.5	3.0
Missouri	95.3	78.0	4.5	8.5	69.5		67.5		71.0	
Nebraska	92.4	79.0	3.8	7.0			80.0	1.0		
Winnipeg	93.4	62.5	22.8	.0	2.5				57.5	8.2
Wisconsin	93.0	80.2	5.0	14.8						
Alb. Dick.	93.2	72.2	2.5	3.8			75.8	2.5		
Northrup-King	97.2	65.5	19.0	15.5			52.0	4.0	59.0	9.8
Mangelsdorf	92.8	79.5	7.8	3.8	72.5	6.8	75.8	3.5	74.8	1.5
Corneli	94.0	77.8			74.5				70.5	
Vaughans	92.7	75.0	7.0		56.6	4.0	58.0	5.0	62.2	.2
N. Dakota	93.4	80.0	4.0	.0	71.0	6.0	69.0	2.0	66.0	3.0
Mean	93.6	73.3	9.2	5.4	56.3	7.3	66.9	3.3	66.5	4.1
Diff. in Extremes	4.8	17.5	19.0	15.5	72.5	11.5	18.0	5.2	17.5	9.6

The chairman for Region No. 2 wishes to express his sincere thanks to all those analysts who so generously cooperated in maing the work of the year so successful.

Report for Region No. 3

C. W. Leggatt

Region No. 3 may be considered as constituting the sub-committee on sand tests, since during the past year we have again been concentrating on this phase of germination work. Thus the following report is also that of the sub-committee on sand as a substratum for germination. There are 19 laboratories included in Region No. 3, of which three are commercial laboratories.

The samples distributed, with their approximate germinations and the number of stations taking part in each case are given in the following tabulation:

Sample	Kind	Approximate germination	Station participating
		%	
No. 1	Cabbage	60	9
No. 2	Onion	65	13
No. 3	Peas	80	12
No. 4	Beans	70	12
No. 5	Mangel	80	16
No. 6	Sweet Clover	30	13
No. 7	Alfalfa	40	13

On the whole very satisfactory cooperation was received, especially in the later samples. While there is still a regrettable lack of uniformity in some cases when judged by the ideal, there is on the whole an improvement over last year. Each sample may be discussed in turn.

Sample No. 1 - Cabbage - The results submitted by the nine laboratories which took part in this test are given in Table 5, which gives the mean percentages of normal and abnormal sprouts and fresh and dead seeds.

Statistical analyses were made of such of these results as appeared worth while. There is still a great lack of uniformity evident with one striking and, it would seem, significant exception. The tests conducted in the sands habitually used by each station have shewn such a degree of uniformity that it would appear that the only source of variation in those tests was sampling error; the value of P from chi-square test being equal to .57 when calculated from the results of each individual replicate - a more sensitive test than when only the averages of each station are used.

The fact that the uniform sand supplied, far from increasing uniformity has, rather, diminished it owing presumably to unfamiliarity with the medium is rather striking. It is interesting to remark that each station was using, for their own sand, one which had been selected from the sources available to them as being nearest to the Ottawa sand. Familiarity with their own sands has triumphed over the uniformity of the sand supplied. It is hard to say why the tests made in the sand supplied should have shewn such lack of uniformity, but some stations have obviously encountered technical difficulties with the special sand. There is no reason to suppose, however, that given equal experience with the special sand at least as uniform results could have been secured, but as it is hardly practical for all laboratories to use the same sand, it is at least highly satisfactory that such good results have been secured in the sands with which each laboratory is familiar.

The means of all stations for the two sands did not differ significantly, but they did differ significantly from the means of both top of blotter and between blotter tests, being some 9% and 6% lower respectively. Abnormal sprouts were much less affected by experimental error in the sand tests than in the blotter tests. It is probable that the former gave a truer picture of the value of the seed than the latter.

It is of interest to compare the results obtained this year with those obtained on the same sample last year. There appears to have been some loss in vitality which showed up particularly in the sand tests. A distinct improvement in carrying out T. B. tests is evident.

This appears to have been a particularly difficult sample to work with and it is noteworthy that sand tests, using sands to which each station has become accustomed and which, though procured locally, conform in general to a standard which had previously been found satisfactory by the referee, have given results in which the only evident source of variation is that due to random sampling.

TABLE 5. - GERMINATION OF BRASSICA - PERCENTAGES OF NORMAL, ABNORMAL, FRESH AND DEAD

Station No.	Between blotters				Top of blotters				In sand			
									Own		Supplied	
	N	A	F	D	N	A	F	D	N	A	N	A
	%	%	%	%	%	%	%	%	%	%	%	%
1	59.5	4.5	20.2	15.8	68.8	5.0	15.7	10.5	54.5	4.5	49.8	9.0
2	62.3	8.0	12.7	17.0	61.0	6.5	18.0	14.5	55.5	0.0	55.5	0.0
4	53.5	9.2	12.0	25.3	52.3	12.7	5.3	29.7	52.5	4.5	58.0	2.3
6	61.5	7.0	18.5	13.0	65.0	4.8	19.0	11.2	50.5	3.3	54.0	2.0
7	49.8	15.8	15.7	18.7	60.5	10.0	14.0	15.5	49.8	3.5	41.8	2.3
8	55.3	4.0	29.5	11.2	55.0	8.3	20.2	16.5	50.3	4.8	49.3	3.8
14	64.0	15.8	20.2	0.0	68.5	14.5	17.0	0.0	59.0	5.0	60.8	5.3
18	60.0	4.0	0.0	36.0	62.5	4.0	0.0	33.5	52.0	5.3	48.0	3.8
Referee	65.8	5.7	7.8	20.7	66.0	11.0	5.0	18.0	56.0	0.5	56.0	0.5
Averages	59.1	8.2	15.2	17.5	62.1	8.5	12.8	16.6	53.3	3.5	52.6	3.2

TABLE 5 - CONT'D.
Additional Tests

Station No.	Own Soil by method in directions				Regular Soil test				In humid germinator not covered by blotters and in 8 x 100 foot candle hours per day.- Germination			
	Germination				Germination							
	N	A	F	D	N	A	F	D	N	A	N	A
	%	%			%	%			%	%		
18 Referee	57	7			50	7			60.5	0.3		

Sample No. 2 - Onion - On this sample 5 tests were requested in all, two of which, namely those in each station's own sand and in the supplied sand were to be done after the others, being modified according to each analyst's best judgment on the basis of experience with the previous tests. The first test was the standard blotter test, the second in the station's own sand with the recommended method and the third consisted of moisture determinations of the sand at the completion of the test.

Detailed results for germination, abnormal sprouts and remaining seeds for the tests between blotters are given in Table 6 with calculated values of chi-square and P. The results are, undoubtedly, excessively variable in general, and might be held not to reflect as good technique as was the case with the blotter tests last year. Analysis of variance shows that this is largely due to highly significant differences between means of laboratories, an F-value of 3.32 having been obtained with 11 and 36 degrees of freedom.

Considering now abnormal sprouts and remainder, we have P-values of .15 and less than 5×10^{-6} respectively. This, taken in conjunction with the foregoing, would seem to indicate that there is more difference in germination conditions or in samples than in judgment of sprouts, since interpretation of abnormal sprouts appears to be tolerably uniform.

The results for germinations and abnormal sprouts in the first sand test are given in Table 7. These show a far higher degree of uniformity than the sand tests on this sample last year, P being equal to .12 as compared with 5×10^{-5} for last year or, with one station excluded which confessed to having had little experience with onion, as compared with .03. Analysis of variance again shows that the laboratory means vary significantly and there is a moderate positive correlation between the laboratory means in blotters and in sand of +.50 which, however, is not definitely significant. It is interesting to note that the best estimate of the variance due to sampling error, namely that within laboratories, given by the analysis of variance is 20.46 as compared with the theoretical binomial variance of 23.31. The two are very close and do not differ significantly, and are much smaller than the corresponding estimate in the analysis of variance in the blotter tests, which was 32.94 and which differs in a highly significant manner from 20.46 ($P < .0001$)

The interpretation which appears best to fit the facts is as follows. There was, initially, a real slight difference between the samples as sent to the different stations--which, however, was not revealed in the 37-38 tests owing to having been overshadowed by experimental error (Variance within laboratories:- Blotters, 56.61, Sand 40.40). The 38/39 tests exhibit improved technique, especially in the sand tests and at the same time reveal significant differences between the samples distributed. When allowance is made for these differences, the sand tests gave results which varied no more than would be expected on account of random sampling "error". The blotter tests, however, making the same allowance, varied much more. For the purpose of comparison of the two we may use the chi-square tests for "within laboratories" with 36 degrees

of freedom, which give: Blotters P .03
Sand P .66

Thus the first sand tests show that sand is an entirely satisfactory medium for the germination of onion, giving a much better possibility of evaluating normal and abnormal sprouts than the blotter tests.

Table 8 presents observations on moisture and a number of determinations of percentage moisture at the end of the test, initial moisture having been 7%. A rather striking feature of this table is the comparative uniformity of the percentages in the case of Ottawa (Canada) sand and sand of similar texture where the procedure recommended has been followed. There appears to be no advantage in finishing a test with a higher moisture content than 2% with such sand.

In the fourth and fifth tests, based on the experience of the second and third, somewhat less uniformity was attained by the few stations which made the test using their own sand, but practically the same degree of uniformity as in the second test when using Ottawa (Canada) sand.

TABLE 6. - GERMINATION OF ONION BETWEEN BLOTTERS

Station	1 G %	1 A %	1 R %	2 G %	2 A %	2 R %	3 G %	3 A %	3 R %	4 G %	4 A %	4 R %	Ave. G %	Ave. A %	Ave. R %
1	63	4	33	80	0	20	63	7	30	65	8	27	68	5	27
2	61	6	33	65	6	29	67	9	24	71	9	20	66	8	26
3	61	2	37	66	5	29	50	6	44	52	8	40	57	5	38
4	57	5	38	77	2	21	58	7	35	67	3	30	65	4	31
5	66	6	28	61	5	34	67	5	28	63	9	28	64	6	30
7	76	7	17	68	11	21	71	6	23	53	9	38	67	8	25
8	53	4	43	63	5	32	63	4	33	58	5	37	59	5	36
11	75	4	21	76	4	20	72	4	24	70	4	26	73	4	23
14	61	10	29	56	10	34	61	5	34	59	3	38	59	7	34
17	72	2	26	71	4	25	79	4	17	71	1	28	73	3	24
19	59	5	36	58	7	35	60	4	36	63	3	34	60	5	35
20	64	7	29	68	4	28	68	9	23	64	8	28	66	7	27
18 *	65	7	28	65	10	25	65	6	29	73	5	22	67	7	26
Mean	Germinated 64.8			Abnormal 5.5			Remainder 29.8								
X^2	104.9			56.9			105.8								
P	10^{-6}			.15			5×10^{-6}								

* Received too late for inclusion in calculations, but would not appreciably affect results.

TABLE 7. - GERMINATION OF ONION - FIRST SAND TEST

	1		2		3		4		Average	
Station	G	A	G	A	G	A	G	A	G	A
	%	%	%	%	%	%	%	%	%	%
	75		64		63		68		68	
1		5		5		4		5		5
	53		61		59		65		60	
2		2		0		1		0		1
	55		64		64		65		62	
3		2		3		2		4		3
	56		57		67		56		59	
4		1		2		2		1		2
	60		59		66		63		62	
5		2		5		2		1		3
	67		56		61		55		60	
7		1		0		2		0		1
	57		65		54		55		58	
8		0		3		4		2		2
	71		65		61		69		67	
11		0		0		1		0		0
	63		60		65		67		65	
14		3		1		0		1		1
	77		69		69		66		70	
17		2		2		1		3		2
	70		60		61		66		64	
19		1		2		1		0		1
	65		64		69		62		65	
20		0		0		0		0		0
	67		66		67		61		65	
18*		1		2		3		4		3

	Germinated	Abnormal
Mean	63.2	1.6
X^2	58.70	69.8
P	.12	.015

* Received too late for inclusion in calculations, but would not appreciably affect results.

TABLE 8. - MOISTURE DETERMINATIONS.

Station	Observations and Determinations
3	Sand retained moisture surprisingly well.
4	Special Ottawa (Canada) sand in boxes with bottoms perforated more moist than own sand in boxes not perforated. In latter tests uniformly moist throughout depth.

	Test -	Per cent Moisture 1	2	3	4	Remarks
5	Own sand	6.8	4.6	3.8	11.8	2 soaked blotters above and 2 below. Blotters resoaked and drained to add moisture as needed.
A Series of special tests	Ottawa sand	2.1	0.5	2.4	2.0	1 blotter above and 1 below--moisture added directly to blotters as required
	Own sand	8.5	8.4	5.2	5.3	-- ditto --
	Own sand	top 1.2 Bot- tom 1.7	0.7	top 0.5 Bot- tom 1.4	0.6	Average of top and bottom layers given. Max -difference between top and bottom 0.6%
	Sand only no seeds	3.4	3.4	3.5	3.6	In closed germinators - no air vent, no moisture added.
						In closed germinator for 3 days to determine evaporation. Exactly 50% lost during this period.

	Test	Per cent Moisture Top	Bottom	Whole	Remarks
7	1st sand	2.7	3.0		Own sand and Ottawa sand somewhat similar in physical structure.
	2nd sand	3.0	3.3	3.2	
	Ottawa sand	2.4	3.2	2.9	
11	1st sand	4.5	6.0	5.5	
	2nd sand			7.5	Not perforated, water added as needed.
	Ottawa sand			3.5	-- ditto --

14 Somewhat more moist than at start, in 1st sand test. Uniform. In Ottawa sand, lower layer slightly more moist than upper which appeared same as own sand.

TABLE 8. - CONT'D.

17 Top layer, moist, moulding to shape of hand, bottom layer moister, not soggy. Whole held a very even moisture.

20 Top layer 1.9%, Bottom layer 1.8%, whole 2.0%. Moisture distribution at end of test very uniform to eye, texture good, compactness satisfactory.

Sample No. 3 - Peas - The amount of seed available for this sample was unfortunately rather small. The tests were requested by each station's own method and by two sand methods. In the special methods, the question of spacing the seeds was studied, 25 (Special (i)) and 50 (Special (ii)) seeds to a box 4 1/2" x 4 1/2" being used.

The results for normal sprouts are shown in Table 9, together with computations of chi-square for all laboratories and also for all except Laboratory No. 13 which consistently got low results. The values of chi-square at the 1% point are given to facilitate comparison between the different values of chi-square obtained.

There is evident a great lack of uniformity by all methods, the special method (ii) having however, rather unexpectedly, given the least inconsistent results, P having been greater than .01 when laboratory 13 was excluded. Note, however, that the method (ii) has given significantly lower results than method (i) which is the method favoured by the referee. Method (i) has shown considerably greater uniformity than "Own Method".

The interpretation of abnormal sprouts was carried out much more consistently by the "Own Method", a value of P = .19 having been obtained, presumably because of familiarity with the type of sprouts obtained by the usual method in each laboratory. The two special methods gave low P values, method (ii) lower than (i).

In an effort to determine the cause of this excessive variability, correlation ratios between normal and abnormal sprout percentages were determined and are as follows:

Method	r	Limit of significance P = .05	P = .01
Own Method	-.532	.602	.735
Special (i)	-.672	.553	.684
Special (ii)	-.724	.553	.684

It will be observed that moderately high negative ratios were obtained which were; not significant, significant and highly significant for "Own", (i) and (ii) methods respectively. Comparison of these values with the chi-square values in Table 9 shows that the correlation between normal and abnormal sprouts is greater as the degree of variability of normal sprouts is less and, from the previous paragraph, as the degree of variability of abnormal sprouts is greater.

It would appear that these facts may be interpreted as follows:-

(1) Own Method. Here, low uniformity of normal sprouts is associated with good uniformity in interpretation of abnormal sprouts, with only moderate correlation between the two, and that, not demonstrably significant. This points to excessive variability in germination conditions resulting in failure in some cases to bring out the full germination capacity of the sample. Familiarity with the method has, however, brought about reasonable uniformity in interpretation of abnormal sprouts, but this must be looked upon as, at least in part, fortuitous, since a shift in the level of favourability of germination conditions would not necessarily bring about an equivalent shift in the level of abnormal sprout development. However, the only moderate correlation between normal and abnormal sprouts would indicate that this probably has happened and that the greater part of the variability of normals is due to differences in conditions rather than differences in interpretation.

(2) Special Method (i). In this case we have intermediate (though still low) uniformity of normal sprouts associated with intermediate (though low) uniformity of abnormal sprouts and a fairly high, significant correlation between them. This method also gave significantly the highest mean germination. Here it would appear that the major factor in bringing about variability was interpretation of sprouts.

(3) Special Method (ii). The greatest (though still low) uniformity in normal sprouts is here associated with the least uniformity in abnormal sprouts, with a rather high, highly significant correlation between them, coupled with significantly the lowest mean germination. It would appear that the method was uniformly conducted by the different laboratories but was not favourable (owing to excessive crowding). A combination of unfavourable conditions and of interpretation seems indicated as the factor causing the observed variability.

On the whole it would seem that special method (i) holds the greatest promise of being developed into a satisfactory, uniform method. There is no doubt that underlying the immediate causes of variability under discussion the diseased condition of the seed was fundamental.

TABLE 9. - GERMINATION OF PEAS - THREE METHODS COMPARED

Normal Sprouts

Lab. No.	Method			Details Own Method
	Own	25's	50's	
	%	%	%	
1	70.0	88.0	74.0	Sand 18°C.
3	82.7	74.0	65.0	Paper Towels 20 - 30°C, 8 days
4	83.5	84.0	84.0	Not Given
5	--	86.0	85.0	
6	77.5	87.0	85.0	Sand, 8% Moisture - 20°C, 7 days
7	91.0	90.0	75.0	Brick Sand, Room T°. Water as needed
8	82.8	70.0	78.0	Not Given
11	76.5	86.6	80.0	Paper Towels 20° C; Rolled
12	83.0	87.0	83.0	Paper Towels 19° C; Rolled
13	60.0	72.0	64.5	Paper Towels, Rolled
18	81.7	85.0	77.0	Greenhouse 21° C, night; 21-32°C, day.
19	84.0	88.0	83.0	Sand 20% moisture covered 3/4".
Seed Research Ottawa	—	82.0	74.0	We use Special (i) as "own" method.
Mean	79.8	83.0	76.6	
X^2	59.41	37.43	30.99	
n	10	12	12	
P	<.01	<.01	<.01	
X^2 at 1% point	23.21	26.22	26.22	
Mean (Excl. No.13)	81.0	83.9	78.6	
X^2	35.23	29.27	23.48	
n	9	11	11	
P	<.01	<.01	.016	
X^2 at 1% Point	21.67	24.73	24.73	

Sample No. 4 - Beans - As in the case of Sample No. 3 - Peas, three methods of germination were used and somewhat similar results were secured. The beans were spaced 25 to a box in each special method but in special method (ii) the tips of the beans were exposed, the idea being that the uneven moistening of the seed coat would tend to rupture it and facilitate germination. The data for normal sprouts are given in Table 10, together with the results of the chi-square tests. (It should perhaps be mentioned that the amount of seed in most cases was very limited, frequently less than 100 to a test; the chi-square test of course was carried out on the actual data and not on the percentage figures

which are reported in the tabulation. This was also true of sample No. 3.)

Some laboratories have consistently given low results and therefore chi-square has been computed in certain cases excluding the results from those laboratories. Comparison of normals and abnormals would suggest that in some cases these exceptionally low results were due to unfavourable germination conditions, in some to much more severe interpretation of abnormal sprouts. In the case of Station 18, subsequent correspondence revealed that the sample sent was definitely of lower quality.

The following tabulation gives the chi-square results for abnormals and their means:-

Results Included	Method	Mean	X^2	P	X^2 1% point
All	Own	16.8	11.54	.18	
All ex. 13 & 18	Own	15.7	7.64	.27	
All ex. No. 18	(i)	23.2	29.83	$<.01$	23.21
All ex. 13 & 18	(ii)	25.4	29.49	$<.01$	23.21

From Table 10 it is seen that "Own Method" excluding 13 and 18 has given a highly significantly greater mean ($P<.01$) than either of the other two methods. It also is the only method that has given a satisfactorily uniform series of results ($P=.70$). It has, also, both with and without stations 13 and 18, shown uniform interpretation of abnormal sprouts ($P=.18$ and .27 with and without 13 and 18 respectively.) However, when 13 and 18 are excluded there remain only a few stations, 7 in all, which carried out tests by their own method. When all stations are included special method (i) shows considerably less variability than "Own Method", while their means show no significant difference. (Note, however, that station 13 was unable to do method (i) on account of lack of seed). This would appear to indicate that special method (i) has merit and that when analysts are more familiar with it, it would probably be suitable as a standard method.

The following tabulation gives the correlation ratios between normals and abnormals:-

Method	r	1% point	5% point
"Own"	-.471	.80	.67
Special (i)	-.853	.71	.58
Special (ii)	-.464	.68	.55

As with the tests on Peas we find negative correlations but in only one case, Special (i) is the correlating significant, and it is then highly so. Also it is a rather high correlative figure. This points to the probability that in these two samples the differences are mainly due to interpretation, aggravated, however, by the diseased condition of the seed. The sand method with sufficiently wide spacing appears distinctly promising as a standard method, but owing to the compactness of the rag-doll method favoured by many laboratories, it is questionable whether it could be adopted except for special samples.

Sample No. 5 - Mangel - This lot proved very unsatisfactory since evidently the samples sent out were very far from uniform. The results are given in Table 11. Normal, abnormal and dead balls all gave very great values of X^2. Correlation studies showed that interpretation of dead balls was clear-cut but that some uncertainty existed in the interpretation of normal and abnormal sprouts.

TABLE 10. - GERMINATION OF BEANS - THREE METHODS COMPARED.

Station	Own Method	Special (1)	Special (11)	Details own Method
	Normal Sprouts			
	%	%	%	
1	77	62	58.7	Sand 18°C
3	70	78	66	Not Given
4		70.6	47.8	
5		66	63	
6	81.2	76.6	65	Sand, 8% moisture 20-30°C, 8 days
7	78.6	73.2	85.4	Brick Sand, Room T, Watered as needed.
8	74.5	76.6	61.6	Not Given
11	78	80	70.6	Rolled Paper Towels 20-30°C
12	79	78	82	Rolled Paper Towels 19-30°C
13	53		26	Rolled Paper Towels
18	46	49.4	42.6	Greenhouse, 24°C, night; 21-32° C, day
19		60	64	
Seed Research Ottawa	As special method (1)	70	71	Special (1) preferred)
Mean	70.6	69.2		
X^2	60.03	34.04		
n	8	11		
P	<.01	<.01		
X^2 1% Point	20.09	24.73		
(Excluding 13 & 18)				
Mean	77.3	70.9	65.7	
X^2	3.85	19.63	30.07	
n	6	10	10	
P	.70	.04	<.01	
X^2 1% point			23.21	

TABLE 11. - GERMINATION OF MANGEL

Station	Germination	Abnormal	Dead
	%	%	%
1	76.8	1.7	21.5
2	83.8	0.7	15.5
3	84.5	2.3	13.2
4	85.0	2.5	12.5
5	68.5	4.3	27.2
6	66.3	5.0	28.7
7	80.3	6.2	13.5
8	78.5	6.5	15.0
11	71.8	0.2	28.0
12	89.3	0.2	10.5
13	75.3	6.7	18.0
14	79.5	1.5	19.0
17	76.8	1.7	21.5
18	87.5	1.0	11.5
19	87.8	0.7	11.5
Seed Research Ottawa	84.0	0.8	15.2
Mean	79.7	2.6	17.7
X^2	175.7	166.5	151.9
n	15	15	15
P	→ 0	→ 0	→ 0

TABLE 12. - GERMINATION OF SWEET CLOVER

Station	Between Blotters				Sand	
	Norm.	Abnorm.	Hard	Dead	Norm.	Abnorm.
	%	%	%	%	%	%
1	31.3	29.0	5.5	34.2	27.8	13.5
2	14.8	39.0	3.5	42.7	28.0	10.0
3	27.3	31.2	4.0	37.5	32.3	8.0
4	13.3	43.7	5.8	37.2	21.8	20.2
5	41.8	23.5	5.5	29.2	40.3	18.7
7	33.0	29.8	3.7	33.5	35.8	4.7
8	30.8	34.2	1.5	33.5	39.0	7.0
11	29.8	24.5	2.7	43.0	36.5	7.3
12	31.3	23.5	4.2	41.0	23.0	7.3
14	26.8	22.0	5.5	45.7	32.3	10.5
17*	45.5	15.3	4.7	34.5	44.0	2.3
19	41.5	22.5	2.8	33.2	34.5	0.0
Research Ottawa	21.8	30.5	5.5	42.2	36.3	2.0
Mean	29.9	28.4	4.2	37.5	32.2	8.6
X^2	214	140	21.4	50.9	94.2	228.3
n	12	12	12	12	12	12
P	→0	→0	.046	<.01	→0	→0
X^2 (p=.01)	26.2	26.2		26.2	26.2	26.2

* Very rarely has Sweet Clover to test.

TABLE 13. - GERMINATION OF ALFALFA

Station	Between Blotters				Sand	
	Norm.	Abnorm.	Hard	Dead	Norm.	Abnorm.
	%	%	%	%	%	%
1	41.8	11.0	32.8	14.5	46.5	8.0
2	33.3	18.3	33.0	15.5	41.8	1.3
3	36.8	11.0	32.5	19.8	43.8	10.0
4	39.8	17.3	28.5	14.5	32.5	15.3
5	40.0	17.0	28.5	15.0	39.8	8.8
7	42.5	12.3	32.3	13.0	43.5	5.5
8	45.0	10.0	31.5	13.5	45.3	1.5
11	42.8	11.8	28.3	17.3	43.5	6.5
12	38.0	11.0	26.8	24.3	40.0	6.8
14	38.8	8.0	35.0	18.3	40.0	6.5
17	48.5	7.5	32.5	12.5	49.3	3.5
19	49.5	11.8	26.2	12.3	44.0	0.0
Seed Research Ottawa	43.5	9.0	31.3	16.3	39.3	4.5
Mean	41.5	12.0	30.7	15.9	42.3	6.0
X^2	38.6	52.8	13.9	40.7	33.2	141.5
n	12.	12.	12.	12.	12.	12.
P	.01	.01	.41	.01	.01	0.
X^2 (p = .01)	26.2	26.2		26.2	26.2	26.2

Samples No. 6 and No. 7 - Sweet Clover and Alfalfa - These two samples were sent out mainly to see how laboratories would interpret sprouts in such poor material. All stations reported results which showed the two samples to be worthless but there was wide difference of opinion as to what were to be considered normal and what abnormal sprouts. There was insufficient unanimity even to provide a criterion to check the judgment of individual stations.

On the whole the alfalfa tests were considerably more uniform than the sweet clover tests (Tables 12 and 13). There seemed, in many cases, to be a lack of confidence in the sand test as an eliminator of abnormal sprouts coupled with, in certain cases, an insufficiently rigorous method. The results for the sweet clover blotter tests pointed strongly to straight differences in inter-

pretation being responsible for the observed variations since if the hard seeds are tabulated as a distribution, taking the individual replicates, and are compared with the corresponding binomial distribution for a mean of 4.2%, the chi-square test gives a value of P=.64, indicating that on the whole the lot was properly mixed. The mean of the sand tests was higher than that of the blotter tests but the difference was hardly significant.

In the alfalfa there was much more general agreement, fairly high values of P being obtained when one or two stations were eliminated on account of very obvious differences in interpretation.

Considering the extreme character of these samples, the results on the whole appear not to have been altogether unsatisfactory. In both cases the sand test gave greater uniformity than the blotter tests.

Summing up the work for the season, we may draw the conclusion that sand is proving a satisfactory medium for germinating the species we have been considering but that it is still proving difficult to get each station to reproduce exactly a given technique. We have found that in our own laboratory we are able to run a row of replicate tests in sand and repeat exactly the same technique in each test as judged by the results obtained. I believe that a valuable contribution could be made to this study by having each station run a large number --say 50 or 100-- of replicate sand tests of a single sample. In this way we could determine how uniformly each laboratory could carry out a sand test and also determine differences in the level of interpretation between the various stations. The referee would then be in a position to make useful suggestions for coordinating the techniques used.

In closing this report for Region No. 3, I would like to express my very sincere appreciation of the carefull and thoughtful cooperation that has been accorded. This cooperation is increasing in extent, pointing to a realization of the value of referee tests by those who start to take part in them. This seems to be a potent argument for those in the region who have not yet done so to come in and help to increase the value of this work.

Report for Region No. 4

W. L. Goss

The chairman of this region found himself unfortunately in the position that he was unable to organize referee testing owing to the few laboratories in his region, the lack of cooperation of two of them, the liquidation of a third owing to lack of financial support and general pressure of work. He made the recommendation that more attention should be paid to referee samples for the Association as a whole and states "I appreciate the argument that samples sent out as a general referee test are sometimes of a kind seldom encountered by individual laboratories. I feel, however, that it is important that all laboratories should be able to handle any kind of seed of material agricultural significance with a fair degree of accuracy. I believe that general referee samples help to accomplish that end."

Report for Region No. 5

C. M. Bass

Region No. 5 was composed of the District of Columbia and the following states: Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Maryland,

North Carolina, South Carolina, Tennessee, Virginia and West Virginia.

One Canadian Laboratory, at Ottawa, four commercial laboratories and the official laboratory of the United States Department of Agriculture cooperated and made tests on most of the samples sent out.

Before any samples were distributed, all laboratories in this region were contacted by letter and urged to participate insofar as their facilities would permit. Analysts were requested to suggest kinds of samples and problems they desired to work with. Most laboratories replied and expressed a desire to receive the samples and make the tests. Some suggestions were made as to the nature of the work to be undertaken. These were followed as far as it was practicable. Several laboratories were unable to make the tests owing to routine testing or inadequate facilities.

Six samples were distributed during the year. Thirteen official and four commercial laboratories tested two or more of the samples submitted. A total of seventy-four reports was received. On these were recorded six-four blotter tests, fifty-eight sand and soil tests; and nine reports were received on classification of Vicia species.

One of our principal studies for the year was to determine the extent, cause and possible means of correcting some of the wide difference in germination which are frequently reported by different analysts on identical lots of seeds. This project involved two kinds of seed. One lot was red clover and the other, sweet clover. Each of these lots was divided into two parts. First parts of the two kinds were numbered Samples 1 and 4 respectively and mailed out to the laboratories on October 25, 1938. The second section of subsamples was mailed out on February 5, 1939, and given numbers 2 and 5 respectively. This gave each laboratory an opportunity to make two separate tests on each of the kinds at about three month intervals.

Neither of these lots was strong in germination. The red clover developed a considerable number of broken and weak seedlings. The sweet clover was decidedly weak and developed considerable decay. These lots were typical of many lots that were being tested and sold. The results reported by the various analysts as listed in tables Nos. 14 and 15 show rather conclusively that these weakened or broken seedlings and the various interpretations given them constitute a responsible factor in uniform testing.

Soil and sand tests were requested on these lots. The response to this request was very good. There was practically no difference in germination results reported by the use of sand and soil. On the whole, they are in close agreement and represent more nearly what appear to be actual field values.

A second germination problem had to do with a lot of Korean lespedeza, given Sample No. 6, and listed in Table No. 17. This lot was chosen at the request of one of the commercial analysts. It was submitted with the statement that two germination tests had been reported on it. First test in December, 1938, was 92%, with 5% hard seed. The other, in February, 1939, germinated 62%, with 18% hard seed. These are unusual tests for lespedeza, though this species frequently shows similar variations, but the high hard seed content usually occurs immediately following harvest, and not in February, as claimed.

Many hard seed in lespedeza qhickly become viable after the first of December. It is not uncommon for lespedeza to show a germination of 20% and 75% hard seed as late as early December. In February following, the same seed may germinate 85% with 10% hard. On the basis of reports received in this investigation, it is possible for this lot to have been labelled 63% and 17% hard seed

in one state and 84% germination and 16% hard in another. Here again, personal judgment in counting sprouts, temperature, and moisture control obviously are influential factors affecting uniformity in testing.

A study was undertaken on the classification of Vicia species. Sixteen samples were distributed. In preparing these samples before being sent out, each was made of equal parts by weight of pure seeds of V. sativa. V. villosa, and V. pannonica to approximately 50 grams in size. Theoretically, reports should show (close to) 33-1/3% of each of the species named. The results reported on this lot and listed in Table No. 16 for the most part are in close agreement. Several laboratories reported figures that were out of line. But regardless of results obtained, any analyst who took the time and made an effort to work samples of this nature, shows a desire and a willingness in ascertaining the principles and technique that are essential in handling difficult problems.

Each participating laboratory has been furnished with copies of Tables 14, 15, 16, 17 and 18 included in this report with the request that they be carefully studied and retests made wherever wide differences occur.

While the number of samples sent out is small, considerable interest was shown. Ground work has been laid for better work next year.

From these investigations, the following facts have been fairly well established:

(1) Methods used by various laboratories in conducting tests on samples discussed in this report were not the same in all cases. This may be due to the lack of close observance of the Rules for Testing or to inadequate facilities.

(2) Some wide differences which were reported resulted from different viewpoints on what constitutes strong, weak, and broken seedlings; though as a result of these comparisons, analysts should now be better able to interpret similar tests more uniformly. Only by a continous study, and by comparing tests can analysts hope for the greatest improvement.

(3) Soil tests serve as a valuable index in determining field values and actual germination in certain species.

(4) Through these tests and the tabulation of reports, participating laboratories have been able to see their results as they are compared with others and recheck them when they are out of line.

In conclusion, I wish to express my sincere thanks to those who have made these studies possible and for their splendid cooperation and support. Benefits derived from our studies have been two-fold: First, we have a better understanding of some of our problems with which we are mutually concerned; and second, the importance of uniform tests has been more forcibly brought to the attention of all participants by meeting them face to face by comparisons.

It has been a pleasure for me to work with such a fine group of analysts as is found in Region No. 5. Some of them are old in experience and years of service; other are younger. Some of the laboratories have larger working staffs, and are better equipped. Naturally, these conditions have a great deal to do with the ease by which all work in done; but this effect on participation in in referee testing has been remarkably small.

I congratulate especially these smaller laboratories for the splendid work which they have done. May we look forward to greater accomplishments for the year 1939-40.

TABLE 14. - TABULATION OF REPORTS RECEIVED ON SAMPLE NUMBERS 1 AND 4 RED CLOVER (TRIFOLIUM PRATENSE).
Both Representing the Identical Lot.

Key to Lab. and Sample No.		Blotter Tests			Sand Test	Soil Test
		Strong Sprouts	Weak Sprouts	Broken Sprouts	Strong Seedlings	Strong Seedlings
		%	%	%	%	%
B (*)	1	78	10	2	80	73
(*)	4					Two months
A	4	75	12	4	-	78in greenhouse
J	1	83	7	4	-	-
	4					
H	1	82	4	4	75	73
	4	63	3	3	26	45
L	1	75	11	5	73	68
	4	66	12	9	75	78
Ottawa	1	67	15	9	72	-
	4	70	11	14	73	-
E	1	72	10	10	71	75
	4	74	7	7	77	75
U.S.D.A.	1	68	9	10	67	68
	4	71	11	8	71	65
Va.	1	72	11	8	70	69
	4	78	5	11	73	76
F	1	93	1	1	76	69
	4					
?	1	72	5	12	-	-
	4					
D	1	71	12	8	-	-
	4	83	5	3	56	-
C	1	78	4	10	-	77
	4	82	4	7	-	-
Commercial Laboratories						
Q	1	78	6	6	-	-
	4	76	8	7	-	-
P	1	78	5	8	-	-
	4					
R	1	80	3	4	-	-
	4	64	-	8	82	-
T	1					
	4	73	14	7	-	-
Mean	1	76	8	8	73	71
	4	74	10	8	67	68

** Sample Numbers 1 and 4

TABLE 15. - TABULATION OF REPORTS RECEIVED ON SAMPLES NUMBERS 2 AND 5 SWEET CLOVER (MELILOTUS SP.).
Both Representing the Identical Lot.

Key to Lab. and Sample No.		Blotter Tests		Sand Test	Soil Test
		Strong Sprouts	Weak Sprouts	Strong Seedlings	Strong Seedlings
		%	%	%	%
B (*)	2	43	18	39	-
(*)	5				
J	2	62	13	-	-
	5				
A	5	38	27	38	31 -5 weeks in soil
H	2	77	6	60	-
	5	34	20	17	29
L	2	55	21	41	46
	5	39	19	43	18
Ottawa	2	45	32	47	-
	5	39	25	33	-
E	2	41	31	33	36
	5	37	29	34	36
U.S.D.A.	2	43	25	42	45
	5	33	15	34	37
Va.	2	46	26	42	45
	5	41	18	32	31
F	2	73	3	49	-
	5				
?	2	48	28	-	-
	5				
C	2	56	22	-	43
	5	58	9	-	-
D	2				
	5	42	20	36	-
Commercial Laboratories					
Q	2	49	17	-	-
	5	34	17	-	-
P	2	50	18	-	-
	5				
R	2	43	8	47	-
	5	43	15	38	-
T	2				
	5	30	31	-	-
Mean	2	55	19	44	43
	5	38	21	33	30

** Sample numbers 2 and 5

TABLE 16. - SAMPLE NO. 3 - VICIA SPP.
Variety Determination

Key to Laboratories	Vicia sativa	Vicia villosa	Vicia pannonica	Other Spp.
		Official Laboratories		
	%	%	%	%
D	34.03	28.36	37.61	
B	33.25	33.40	33.35	
F	32.84	32.33	33.70	1.12
Va.	35.42	35.30	33.28	
E	35.99	35.18	32.83	
H	54.94	31.27		13.79
U.S.D.A.	33.53	33.27	32.99	0.21
A	33.73	33.15	32.79	0.34
		Commercial Laboratories		
P	33.81	33.21	32.98	
Mean (a)	35.95	32.39	29.95	1.72
Mean (b)	35.33	32.53	33.69	0.21

Note: (a) Including reports from all laboratories reporting.
(b) Omitting reports from Laboratory H.
In preparing these samples before being sent out, each was made up of equal parts by weight of pure seeds of V. sativa, V. villosa and V. pannonica to approximately 50 grams in size. Theoretically, reports should show close to 33-1/3 per cent by weight of each of the three species named.

TABLE 17. - TABULATION OF REPORTS RECEIVED ON SAMPLE NO. 6
Korean Lespediza - Lespedeza Striata

Laboratory	Germination	Hard Seed	Germination Plus Hard Seed
		Official Laboratories	
	%	%	%
A	79	19	98
C	84	16	100
U.S.D.A.	78	19	97
D	66	19	85
Virginia	82	15	97
Ottawa	78	17	95
E	78	19	97
F	70	19	89
H	63	17	80
		Commercial Laboratories	
Q	79	14	93
T	69	21	90
R	80	13	93
Mean (a)	76	17	93
Mean (b)	80	16	93

Note: (a) Including reports from all laboratories reporting.
(b) Omitting reports from Laboratories D, H, and T.

TABLE 18. - SUMMARY OF REFEREE TESTS - REGION NO. 5. 1938-39.

Sample No., Kinds, and Number Laboratories Reporting	Species Determination			Germination					
	Range		Mean	Blotter		Sand		Soil	
				Range	Mean	Range	Mean	Range	Mean
	%	%	%	%	%	%	%	%	%
1 -Red clover (15)(a)				76-93	76	67-80	73	69-77	71
4 -Red Clover (12)(a)				63-84	74	23-82	67	45-78	68
2 -Sweet Clover(14)(b)				41-77	55	33-60	44	38-46	43
5 -Sweet Clover(12)(b)				30-43	38	17-43	33	18-37	30
3 -Vetch (9)									
Sativa	33.25	34.02	33.33						
Villosa	28.36	33.40	32.53						
Panonnica	32.79	37.61	33.69						
6 -Lespedeza (10)				63-84	75	Not requested			

Note: (a-a) Identical lot; (b-b) Identical lot.

The report of one of the sub-committees, namely that on sand tests has been included under that of Region No. 3.

Sub-Committee on Techniques for the Analysis of Small Seeds

R. H. Porter

During the year 1938-39 this committee continued the study begun last year

to determine if more uniform pure seed fractions could be provided by a uniform method of purity analysis. Two kinds of grass seeds were used, namely, orchard grass and Kentucky bluegrass.

The methods employed and the results obtained are given under the report which follows. In addition to these two kinds of seeds, each of the six cooperating laboratories took part in a similar test with reed canary grass which was used in Region No. 2. The data obtained are given under the general report for region No. 2 which should be studied in connection with the work of this sub-committee.

One other test in region No. 2 in which the members of this committee took part dealt with germination of uniform pure seed fractions of bluegrass. The report of the work of this committee on bluegrass should also be compared with the report for region No. 2.

Summary of Orchard Grass Referee Test. Fall 1938

The purpose of this referee test was to further investigate the possibility of using the modified uniform method of analyzing orchard grass seed and to compare the pure seed fractions obtained by this method with those obtained when the official method is used. The procedure was as follows:

From a well mixed lot of orchard grass seed from the 1938 crop, 12 sub-samples, whose weights ranged from 1650 to 2050 milligrams, were drawn and analyzed by the uniform modified method using air pressure as the criterion of separating heavy and light fractions. The pure seed fractions of sub-samples 1 to 6 labeled "a" were subdivided into two approximately equal portions, one of which was retained by the Iowa Laboratory for a germination test and the other sent to one of six laboratories. Each laboratory was requested to test the fraction by using 400 seeds placed on top of moist sand in petri dishes and 400 by the method preferred. The Iowa Laboratory tested 400 seeds of each of the six pure seed fractions on top of moist sand.

The results of the studies with sub-sample "a" one to six are given in the upper part of Table 19. It should be noted that the percentages of purity obtained in the Iowa Laboratory are uniform, likewise the percentages of germination and the index values (purity x germination) are also uniform as judged by a theoretical method of computing chi-square.

Column 6 shows the percentage of germination obtained by each laboratory on the same sub-samples of pure seed on top of moist sand. The results are far from uniform, caused no doubt by unfamiliarity with the method of germination. Similarly the index values in column 7 are not uniform. Columns 8 and 9 contain the data from the same pure seed fractions when the method preferred by the laboratory was employed. The uniformity in column 8 is satisfactory although less so than in column 4 and the index values in 9 are just under the 5 percent point. The data as a whole show that the pure seed fractions were uniform, the method of analysis was uniform and that lack of uniformity in germination in column 6 should not be charged against the pure seed fractions but rather against the method employed. When the purity analyses are uniform and germination is uniform, the resulting index values are likewise reasonably satisfactory.

Sub-samples 7 to 12 were labeled "b", the portions recombined and the six laboratories each received one with the request that a purity test be made by the official method after which a germination test of the pure seed fraction thus obtained was to be made by the method commonly used by the laboratory.

The results of the several tests with the 6 sub-samples labeled "b" are shown in the lower portion of the table. Column 3 shows the percentages of purity obtained by the modified method in the Iowa laboratory and column 4 the percentage obtained by each laboratory when the official method was employed. The results are highly uniform in column 3 but not in column 4. The percentage of germination obtained by each laboratory is shown in column 5 and the uniformity is fair but not so good as in column 8 in the upper part of the table. The index values are not uniform in that the probability is less than .01.

The method used to compute chi-square for the index values (purity x germination) is theoretical. The factor used is an average of that for purity and germination respectively. For example, the factor for purity is 23 (2300 seeds per 2 grams) and for germination is 4, hence $\frac{23 + 4}{2} = 13\text{-}1/2$ the factor used in computing chi-square for the index values. If the theoretical method be correct then we may say that when the index values for similar samples of orchard grass average 72-73, a difference in extremes below 5 may be considered reasonable.

Conclusions which may be drawn from the above tests are as follows:

1. The modified method of making purity analyses of orchard grass gives results well within the range of natural variability and much more uniform than does the official method.

2. The pure seed fractions of orchard grass obtained by the modified, uniform method are uniform as shown by germination tests under uniform conditions.

3. The six laboratories which participated have fairly uniform methods of testing orchard grass seed for viability.

4. If either the purity or germination percentages obtained with uniform sub-samples of orchard grass seed are not uniform (outside the range of natural variability) the index values may be expected to be too variable.

TABLE 19. - SUMMARY OF ORCHARD GRASS REFEREE TEST. FALL 1938.

Name of Laboratory	Sample No.	Sub-sample "a" Iowa Tests Purity	Iowa Tests Germ. Top Sand	Iowa Tests Index	Germination by Lab. Top Sand	Germination by Lab. Index	Germination by Lab. Own Method	Germination by Lab. Index
		%	%	%	%	%	%	%
Kentucky	1	86.9	81.8	71.1	82.0	71.3	83.0	72.1
U.S.D.A.	2	88.0	85.3	75.1	78.8	69.3	86.0	75.7
Mass.	3	86.2	84.3	72.7	81.5	70.3	83.8	72.2
Ottawa	4	87.5	84.8	74.2	80.8	70.7	80.8	70.7
Winnipeg	5	87.9	82.5	72.5	77.0	67.7	81.0	71.2
Iowa	6	86.7	86.5	75.0	87.0	75.4	85.0	73.7
	Mean	87.2	84.2	73.4	81.2	70.8	83.3	72.6
	X^2	5.27	4.59	7.07*	15.38	21.87	6.06	11.54*
	P	.40	.45	.20	<.01	<.01	.30	.04
	Diff. in Extreme	1.8	4.7	4.0	10.0	7.7	5.2	5.0

* Theoretical

Sub-sample "b"

Name of Laboratory	Sample No.	Iowa Purity	Official Method by each Laboratory Purity	Germ.	Index
		%	%	%	%
Kentucky	7	87.2	87.7	84.3	73.9
U.S.D.A.	8	86.2	79.2	84.0	66.5
Mass.	9	86.5	85.6	88.8	75.0
Ottawa	10	87.4	87.2	83.8	73.1
Winnipeg	11	87.0	88.6	82.0	72.6
Iowa	12	86.4	85.3	86.0	73.3
	Mean	86.8	85.6	84.7	72.4
	X^2	2.34	106.26	8.82	30.51
	P	.80	<.01	.13	<.01
	Diff. in Extremes	1.2	9.4	6.8	8.5

Summary of Referee Test with Kentucky Bluegrass

Sixteen sub-samples of bluegrass seed each with a weight of about one gram were drawn from a lot with a bushel weight of about 21-1/2 pounds. Thirteen sub-samples were then selected and tested for purity by the uniform method of procedure. The separations from the first five were then recombined, labeled "x" and each of five laboratories received one of the sub-samples with the request that a purity test by the official method be made, also a germination test of the pure seed fraction by the method preferred.

The pure seed fractions of the remaining eight sub-samples, designated as "y" were each subdivided into four parts, a,b,c and d. These were considered as uniform pure seed fractions and the "d" portion of each was retained by the Iowa laboratory for a germination test on top of moist sand under uniform conditions. The remainder of the 24 pure seed fractions were kept separate and each of the 24 laboratories received a sample with the request that a germination test of 400 seeds be made on top of sand and a second test of 400 seeds be made by the method preferred (See report for region No. 2).

The results of the tests by six laboratories (those constituting the subcommittee to study the analysis of small seeds) are shown in Table 20.

TABLE 20. - SUMMARY OF PURITY AND GERMINATION TESTS WITH BLUEGRASS SEED 1939.

Sample No.	Purity			Germ.		Germination - Uniform Pure Seed Fractions		
	Iowa Lab.	Name of Lab.	Coop. Lab.	Coop. Lab.	Index	Sample No.	Coop. Lab. Sand	Coop. Lab. Own Method
	%		%	%	%		%	%
1	86.8	Ky.	87.6	87.0	76.2	6a	91.2	86.2
2	85.8	USDA	86.0	84.0	72.2	6b	81.3	82.3
3	86.1	Ottawa	85.9	78.5	67.4	6c	83.3	84.3
4	85.2	Mass.	84.9	81.3	69.0	7a	73.8	77.8
5	86.6	Winn.	88.5	76.5	67.7	7b	84.0	83.0
6	87.2	Ia.	87.2	86.0	75.0	6d	86.0	
						7d	85.8	
Mean	86.3		86.7	82.2	71.3		83.6	82.8
X^2	10.75		36.1	46.4				
P	.07		<.01	<.01				
Diff. in Extreme	2.0		3.6	10.5	8.8		17.4	8.4

Further information as to the uniformity of the pure seed fractions from the eight sub-samples No.s 6 to 13 is given in Table 21.

TABLE 21. - SUMMARY OF PURITY AND GERMINATION TESTS BY IOWA LABORATORY WITH EIGHT SUB-SAMPLES OF BLUEGRASS SEED FROM THE SAME LOT.1939.

Sample No.	Purity Uniform Method	Germination Uniform Method Portion "a"	Index Value
	%	%	%
6	87.2	86.0	75.0
7	85.6	85.8	73.4
8	86.9	86.8	75.4
9	84.9	84.0	71.3
10	86.5	84.5	73.1
11	85.9	85.8	73.7
12	85.9	85.8	72.2
13	87.4	86.0	75.2
Mean	86.3	85.3	73.6
X^2	21.07	2.59	
P	<.01	.90	
Diff. in Extreme	2.5	2.0	

The data in Table 20 show that purity percentages by the uniform method in the Iowa laboratory were reasonably uniform (P=.07) but purity percentages obtained by six laboratories using the official method were not uniform. Germination percentages as obtained by the several laboratories using their own pure seed fractions were not so uniform as should be expected.

The pure seed fractions sent to each of the six laboratories were uniform as shown by the Iowa tests under uniform conditons in that 6d and 7d have 86 and 85.8% respectively. Germination of these uniform pure seed fractions in different laboratories was not uniform either on top of sand or by the method commonly used.

In Table 21 the data show that (a) the sub-samples as drawn for analysis were not uniform (P<.01) and (b) the pure seed fractions obtained by the uniform method of analysis were uniform in that germination was remarkably uniform (P=.90).

Taken as a whole this test reveals the following:

(a) Sub-samples of bluegrass seed may not always be homogeneous (thorough mixing is required).

(b) The uniform method of making purity tests provides uniform pure seed fractions.

(c) A uniform method of testing bluegrass seed for germination is needed for all laboratories. This should include not only uniform conditions of temperature, moisture and substrate but light as well.

The committee recommends that the approach to the problem of uniform methods in seed testing as indicated in this report be studied further in 1939-40.

Sub-committee on Analysis of Brome Grass Seed

Edith C. Higgins

In continuation of the study initiated in 1938, brome grass samples were distributed in order to compare the results obtained from analyses of 5 and 10 gram samples. Four lots of seed were used from each of which several samples each weighing approximately 10 grams were drawn. Each 10 gram sample was then sub-divided into two parts each weighing nearly five grams. These pairs were then labeled A and B, or in the case of one laboratory where more than one 10 gram sample of a lot was used the parts were designated as C and D and E and F.

The data obtained from the analyses by four laboratories are shown in Table 22. The first column of figures shows the percentages of purity when five gram samples in pairs were analyzed for lot 1. The "p" values when the members of a pair were statistically compared show that there is no highly significant difference, in other words differences between the members of each pair are not greater than might occur in random samples. As between laboratories, however, the differences are highly significant, the lowest being 63.8, the highest 70.8 and the "P" value when all are compared is much less than .01. These differences are undoubtedly the result of variations in the judgment of analysts as to what constitutes pure seed. The sample in question showed some signs of injury with many broken and injured seeds both hulled and unhulled. It emphasizes the old problem of personal judgment. Tests for germination of the pure seed fractions would no doubt throw some light on the subject but such were not conducted

except by one laboratory and they are of no value unless compared with others.

A study of all other pairs of samples 2, 3 and 4 shows that in only one case is the "P" value less than .05, namely the tests by the Minnesota laboratory of sample 2, A and B. Even the pairs of samples A and B, C and D, E and F for sample 2, and A and B and C and D for samples 3 and 4, all by the North Dakota laboratory show no highly significant differences between the members of each pair thereby indicating that with either high or low purity samples when five gram samples are used by a given analyst the results obtained are not in general significantly different.

A comparison of the results with five gram samples by all four laboratories for lots 2, 3 and 4 shows reasonable variation among the laboratories for lot 4, more but not excessive variation for lot 3 and significant differences for lot 2. Apparently the lower the quality the less the chances of agreement among analysts. When the same analyst made analyses of more than one pair (see North Dakota data sample 2, A, B, C, D, E and F) the results are not significantly different although they are at the lower limit. The same indications are apparent for samples 3 and 4, A, B, C and D all by the North Dakota laboratory.

The columns in the table in which percentages are given for ten gram samples show the data for each of the four samples obtained by each of the four laboratories. Each figure was obtained by considering the members of each pair as one 10 gram sample. The total weight of the two five gram samples was divided into the total weight of the pure seed from each member of the pair. A statistical analysis of the data from all of the laboratories with each of the four lots based on 10 gram samples shows that the probability for lots 1 and 2 is less than .01, for lot 2 less than .05 and only for lot 4 is the probability above .05. It should be noted that when calculations are based on 10 gram samples the number of observations for any lot is half the number based on 5 gram samples, hence the degrees of freedom are less and probabilities for a given chi-square are less when the 10 gram samples are considered. Furthermore, the factor for chi-square is twice as great when the calculations with 10 gram samples are made because the basic weight is two fold. In other words, the allowable divergences become less as the size of sample increases. It seems probable that more study should be made as to methods of mixing brome grass before working samples are drawn. More homogeneous lots should give more uniform samples for analysis.

Conclusions

1. Differences between the percentages of purity of members of pairs of five-gram samples of brome grass as obtained by four laboratories were never as great as allowed by the tolerance formula of the Association of Official Seed Analysts and in only one instance was the difference greater than would be expected on the basis of the chi-square test for homogeneity.
2. Differences in purity of brome grass as between four seed laboratroies using five-gram samples were greater than should be expected (basis chi-square test) for samples below 70% pure seed but with samples with over 78% pure seed the differences were not excessive. For only one lot whose purity was below 70% was the difference in extremes greater than allowed by the tolerance formula of the A. O. S. A.
3. When 10 gram samples of brome grass were used in place of pairs of five-gram samples the differences in extremes of purity as obtained by four laboratories were somewhat less than with five-gram samples but the probability of

occurrence was less with the 10 than with the 5 gram samples. Differences as between laboratories are in part cuased by variations in personal judgment.

TABLE 22. - COMPARISON OF PERCENT PURITY OF BROME GRASS SEED. USING SAMPLES OF 10 GRAMS - 4 LABORATORIES - 1939.

	Lot 1		Lot 2		Lot 3		Lot 4	
	grams		grams		grams		grams	
Laboratory	5	10	5	10	5	10	5	10
	%	%	%	%	%	%	%	%
Iowa A	66.7		68.5		77.8		85.2	
B	63.8	65.2	67.9	68.2	77.6	77.7	84.9	85.1
P	.10		high		high		high	
Minnesota A	67.5		70.4		79.1		83.8	
B	67.7	67.6	66.5	68.4	76.8	77.9	84.0	83.9
P	high		.03		.12		high	
N. Dakota A	68.5		68.9		78.3		86.4	
B	70.8	69.7	71.1	69.9	79.6	78.9	86.6	86.5
C			66.0		76.8		83.7	
D			67.6	66.8	78.6	77.7	85.2	84.4
E			66.9					
F			68.4	67.6				
P	.18		.05		.25		.09	
Winnipeg A	70.2		71.1		81.1		85.9	
B	68.7	69.5	71.6	71.3	80.1	80.6	84.2	85.0
P	.12		high		.48		.19	
Mean of all	68.0	68.0	68.8	68.7	78.6	78.6	85.0	85.0
X^2 of all	22.8	18.12	27.9	18.6	15.6	11.04	12.0	9.00
P (all)	<.01	<.01	<.01	<.01	.08	.03	.23	.07
Diff. in extremes	7.0	4.5	5.6	4.5	4.3	2.9	2.9	2.6

4. In view of the time factor involved in the analysis of 10 grams of low quality brome grass the committee believes that if samples are well mixed the results obtained by the use of five-gram samples will be sufficiently indicative of quality for all practical purposes. Even with samples whose purity is about 85% the estimate of quality using 5-gram samples was reasonably uniform and the differences were no greater than may be expected in homogeneous samples of seed.

Sub-committee on Viability of Injured Weed Seeds

C. M. Bass

Systematic study of viability of injured weed seeds was first undertaken by the research committee of this association during 1938. A report of these investigations was presented to the association at its annual meeting at Guelph, Canada, in August, 1938.

It developed as a result of these studies that information concerning proper handling of the various kinds of seeds in a number of instances was lacking. Optimum requirements for germinating normal and uninjured seeds and bulblets which were being considered had not been established. In order that the effect injury has on viability could be determined with any degree of accuracy, it was felt that we should first devote some study to the requirements of normal seeds and bulblets. This phase of the weed seed problem was undertaken this year. We set out with the idea of finding out all we could about germinating successfully perfect weed seeds.

One change was made in the personnel of the weed seed committee. Mrs. Louisa Ames Kanipe of Oregon relieved Miss Lute of Colorado of her study on Rumex spp., Miss Lute having previously accepted chairmanship of another committee. Messrs. L. N. Allen of Alabama, A. L. Stone of Wisconsin, W. H. Wright of Ottawa and F. S. Holmes of Maryland were unable to carry on with their assignments this year, owing to the pressure of other matters. Hence, this report will be

confined principally to four groups of seed, which are as follows:

Rumex spp. - Mrs. L. A. Kanipe, Corvallis, Oregon.

Tests were conducted on three species: Rumex crispus, 7 samples; Rumex salicifolius, 4 samples; and Rumex obtusifolius, 1 sample. Substratum was petri dish with toweling. Sand tests were also made. Number of seed tested: 200 to 600--in multiples of 200. Tests were made in October and January. Constant temperatures at 15° C, and 20° C, were unsatisfactory. After 46 days at 20°, germination varied from zero to 3%; all tests gave zero at 15° C. However, when these tests were transferred to 20° - 30° C, they compared favorably with the results of the tests originally placed at that temperature.

The samples used in these tests represent the seed as grown on the plants. By cleaning and seed selection for weight, size, and appearance, as would occur in a cleaned commercial lot of seed, germination approaching 100% could be obtained in each of the samples except numbers 66128 and 66134 (listed in Table 23). In the case of 66128, all seeds were normal in appearance, but were damaged by heat from a nearby burning field. Sample 66134 contained light weight seed taken from second growth of the plant.

TABLE 23. - REPORT OF EXPERIMENTAL TESTS ON PERFECT WEED SEEDS HARVESTED OCTOBER, 1938. (2 x 100 TESTED IN EACH CASE AT 20°-30° C WITH DIFFERENT SUB-STRATA.).

Kind of seed & sample number	Sub stratum used	Germination %	Duration of tests in days	Sources of seed	Month and year tested
Rumex ob-	P.t.*	42.0	21	Tangent,	10/38
tusifolius	P.t.	51.5	21	Oregon	1/39
#66122	Sa.**	54.5	21		1/39
Rumex	P.t.	47.0	21	Tangent,	10/38
crispus	P.t.	33.5	21	Oregon	1/39
#66127	Sa.	36.0	21		1/39
Rumex sa-	P.t.	65.5	21	Albany,	10/38
licifolius	P.t.	63.0	21	Oregon	1/39
#66131	Sa.	60.5	21	Roadside	1/39
Rumex sa-	P.t.	61.0	21	Corvallis	10/38
licifolius	P.t.	65.5	21	Oregon	1/39
#66133	Sa.	63.0	21	Roadside	1/39
R. crispus	P.t.	87.0	21	Corvallis	10/38
#66123	Sa.	91.0	21	6th St.	1/39
R. crispus	P.t.	91.0	21	Albany	10/38
#66124	Sa.	96.0	21	ditch bank	1/39
R. crispus	P.t.	90.0	21	Corvallis	10/38
#66125	Sa.	89.5	21	Roadside	1/39
R. crispus	P.t.	80.8	21	Corvallis	10/38
#66126	Sa.	82.5	21	20th St.	1/39
R. crispus	P.t.	92.0	14	Corvallis	10/38
#66129	Sa.	92.5	14	Armory	1/39
R.salicifolius	P.t.	90.5	21	Corvallis	10/38
#66130	Sa.	83.0	21	R.R. bank	1/39
R. salicifolius	P.t.	83.0	21	Corvallis	10/38
#66132	Sa.	75.0	21		1/39
R. crispus	P.t.	1.5	58	Roadside	10/38
#66134	Sa.	0.5	58	cut-over	1/39
Rumex sp.	P.t.	7.5	58	Vacant lot	10/38
#66128	Sa.	10.5	58	burned	1/39

* P.t. - Petri dish,towels
** Sa. - Sand

Amaranthus spp. - Miss Verna Jane Thompson, Ames, Iowa.

The studies that were initiated last year with seeds of Amaranthus were continued this year with emphasis on an investigation of the conditions which are most favorable to the germination of normal seeds of Amaranthus spp.

Four lots of seed from screenings were used, two from seed produced in 1937 and two from 1938 seed. Four sets of conditions were provided for each lot, namely 20°, 30°, 20-30° (dark), and 20-30° C with light at the higher temperature. Each test included 400 seeds placed on top of moist blotters in copper trays equipped with wicks.

Readings were made at 3, 7, 16 and 21 days after the test was started. In most cases the germination was practically complete at 16 days and for one lot (1938 a) the test was nearly complete at 7 days.

A summary of the data obtained is given in Table No. 24 from which it is apparent that a constant temperature of 30° C gave the maximum germination. The second best set of conditions appears to be 20-30° C with light at the higher temperature.

Lot "a" for 1937 is the same seed as that used in the tests in 1937-38. It should be noted that the germination one year later is not significantly different from that last year when 90% of the uninjured seeds produced normal sprouts. There seems to be a difference in lots in their response to different temperatures. For example, lot 1938 b at 30°C was not significantly different from lot 1937 b, but at 20-30°C with light it was significantly lower in germination.

The tests with injured seeds in 1937-38 indicated that the seeds were either dead, incapable of producing normal seedlings or developed normal seedlings at a temperature of 20-30°C in the light, and further, that they sprouted more rapidly than uninjured seeds. The high germination (90%) of uninjured seeds at 20-30°C in the 1937-38 tests suggests that the lot in question responded well to the conditions employed and indicated that the comparisons made were correct for that lot. Tests with injured seeds at 30°C must next be made in comparison with uninjured seeds before more definite conclusions can be drawn.

TABLE 24. - EFFECT OF TEMPERATURE ON THE GERMINATION OF UNINJURED SEEDS OF AMARANTHUS SPP. IOWA 1939.

°C	Germination			
	1937		1938	
	a	b	a	b
	%	%	%	%
20-30 light	86	79	59	45
20-30 dark	78	63	47	54
30	95	87	68	83
20	48	48	11	2

Tests with dodder seeds were made by selecting what were thought to be fertile and infertile seeds from a lot of red clover. The infertile group consisted of those pale in color or with ashen gray tinge, usually somewhat larger than normal and more or less easily crushable with tweezers. The two lots each consisting of 600 seeds were placed in the germinator at 20-30°C. The results of the tests are shown in Table 25. Nearly 100% of those classed as infertile were non-viable and only 9.2% of the fertile ones were non-viable. These results confirm earlier investigations[1], namely, that it is possible to select infertile dodder seeds with a high degree of accuracy.

1. Porter, R. H., & Koos, Katharine. Germination of Injured Weed and Crop Seeds. Agricultural Experiment Station, Ames, Iowa.

TABLE 25. - COMPARATIVE VIABILITY OF VISUALLY SELECTED DODDER SEEDS, IOWA 1939.

No.	Germination, fertile			Germination, infertile		
	Normal	Hard	Dead	Normal	Hard	Dead
	%	%	%	%	%	%
1	3	90	7	0	0	100
2	9	84	7	0	0	100
3	3	90	7	0	0	100
4	3	82	15	0	1	99
5	15	74	11	0	0	100
6	5	87	8	0	0	100
Average	6.3	84.5	9.2	0	.2	99.8

Allium vineale (bulblets) - Miss Jennie Jones, Virginia.

Material used in these tests came partly from screenings and commercial field seeds and partly from mature plants in the field. They were all aerial bulblets apparently well ripe and collected in late summer or early fall of 1938. Tests were made shortly thereafter.

This report is based on tests of eight samples. Bulblets were rolled in moist paper towels, but the moisture was kept slightly on the dry side.

To further verify the findings regarding temperature given in our report last year, we continued with very much the same temperature combinations, as indicated in Table No. 26. At temperatures of 10°C and 10°-20°C, we have been able to get all but two of these samples to give germination percentages approaching 100%. Less than one-half of the bulblets in samples 16 and 17 germinated. In sample 16, the bulblets were small, having been taken from orchard grass screenings, while sample 17 was made up of bulblets taken from oat screenings, which perhaps were harvested before the bulblets were fully mature.

A considerable number of dormant bulblets was noted at the completion of tests.

Duration of tests ranged from 30 to 56 days at 10° and 10°-20°C temperatures.

TABLE 26. - REPORT OF EXPERIMENTAL TESTS ON ALLIUM VINEALE (HARVESTED 1938). (Seed obtained from field except as indicated).

Kind of seed & sample number	Number of seed tested	Temperatures used °C	Germination %	Duration of tests in days	Month and year tested
9	100	10	62	56	9/38
	100	10-20	85	56	9/38
	100	20	82	56	9/38
	100	20-30	47	56	9/38
10	100	10	86	48	9/38
	100	10-20	90	48	9/38
	100	20	72	48	9/38
	100	20-30	49	48	9/38
12	100	10	95	48	9/38
	100	10-20	92	48	9/38
16 (a)	600	10	31	30	10/38
	600	10-20	34	30	10/38
	600	20	23	30	10/38
	600	20-30	19	30	10/38
17 (b)	100	10	38	30	10/38
	100	10-20	36	30	10/38
	100	20	35	30	10/38
	100	20-30	9	30	10/38
18	200	10	95	30	10/38
	200	10-20	72	30	10/38
	200	20	54	30	10/38
19	200	10	92	30	10/38
	200	10-20	75	30	10/38
	200	20	64	30	10/38
20 (c)	200	10	86	34	11/38
	200	10-20	73	34	11/38
	200	20	89	34	11/38
	200	20-30	81	34	11/38

All tests germinated in rolled paper towel
(a) Orchard grass screenings (b) Oat screenings (c) Rye screenings.

This report is being submitted as one of progress. The data accumulated is not altogether conclusive. Some fundamental requirements have been determined for a few kinds of seeds, though not to the point where they can be definitely fixed. Work on these same original species of weed seed should be continued at least to the point where specific testing procedures can be recommended.

Perhaps it may be advisable another year to expand our work a little in order that we may more quickly reach that stage of the work for which this committee was created -- determining the viability of injured weed seeds.

In conclusion, I wish to express my sincere thanks to each member of this committee for the interest they have shown in these investigations, and for the contributions which they have made. It has been only through their cooperation that this report was made possible.

Sub-committee on Viability of Hard Seeds

W. O. Whitcomb

At the last annual meeting the question was raised as to the viability of the hard seeds which remain at the end of the usual laboratory germination test. In other words, are we justified in adding all or a part of these seeds to those which germinate promptly and designating them as "total live seed", as is now permitted by some state laws.

The Research Committee undertook a study of this subject and the plan of having as many analysts as would like to cooperate was outlined in the July 1938 issue of the News Letter. The response to this request was encouraging and brought up certain questions. The plan was given in more detail in the December News Letter. Briefly stated this plan was to have the analysts, who wished to cooperate, either treat the seed to make them permeable to water and test the viability or send the untreated hard seed separations to the Montana Laboratory where they would be treated and tested.

As a result of this request, 11 laboratories submitted hard seed separations and two analysts made special studies on their own treated seeds.

Tests in U. S. Department of Agriculture Laboratory - Mrs.Vivian K. Toole of the U. S. Department of Agriculture made tests on 12 species of legume seeds. The seeds were held with forceps and scarified on the opposite side of the scar with an electric needle as described by Shuck[1]. The results of this study as given in Table 27, show that the strong sprouts varied from 55% in Trifolium hybridum to 98% in Medicago hispida. The abnormal sprouts ranged from none to 30%, while the dead seed ranged from none to 15%.

Tests in Missouri Laboratory - Martin E. Crowson of the Missouri Laboratory made tests with six species of legume seeds. The hard seeds which remained on the blotters at the end of the regular germination tests were touched with the electric needle, as described by Shuck[1] and then allowed to germinate on the original blotters. The results as given in Table 28, show that the strong sprouts ranged from 65% in alsike clover to 87% in Korean lespedeza. The abnormal sprouts ranged from 9% to 23%.

Tests in Montana Laboratory - The tests made in the Montana Laboratory differed from those above noted in other laboratories in two respects. First, the hard seed separations were allowed to dry after removal from the blotters and second, the seeds were treated with concentrated sulphuric acid instead of with the elctric needle. The work in the Montana Laboratory should be considered as cooperative because the seeds were furnished by a number of laboratories as

1. Shuck, A. L. Some suggestions for testing the viability of hard seeds. Pro. Assn. Off. Seed Analyst North America. 1935:62, 1936

indicated in the tables which are given as a part of this paper.

Method - The hard seed separations were first tested two times for germination without treatment by the usual method which was as follows: Alfalfa, clover, lespedeza and astragalus between blotters at 20°C for 5 days; vetch in paper towels at 20°C; and beans in paper towels 10 days at 20 and 30°C. The hard seeds remaining at the end of the second test were treated with concentrated sulphuric acid by the following procedure; (1) seeds placed in a 400 cc beaker and covered with acid and allowed to stand for 10 minutes (2) the beaker was quickly filled with cold water (3) the water was carefully decanted off and the beaker refilled four times (4) the seeds were covered with water and indicator added to insure that all traces of acid had been removed. (5) the seeds were placed on dry blotting paper and allowed to dry for four hours or more before being tested. It is worthy of note at this point that the seeds were not burnt or discolored by the acid. This treatment was the same for all seeds, except that the time was varied as follows; alfalfa, red clover, alsike clover, white clover, peas, beans and lespedeza each 10 minutes; and sweet clover, astragalus, sweet peas, vetch and lupines each 20 minutes.

Following the treatment, the seeds were counted out and treated in the usual manner. (The summation of the percentages of germination for the various tests for any one lot of seed does not equal 100 because the hard seeds from the replicate tests were combined for each treatment and test.) The hard seeds remaining at the end of the test were again treated and subjected to the usual test. This procedure was repeated until no hard seeds remained, or in some cases as much as six times. Even after six treatments hard seeds remained in some cases.

Results at Montana Laboratory -

Alfalfa - As shown in Table 29, hard seeds of alfalfa were received from nine laboratories. The first test without treatment showed that germination ranged from 9% on Vancouver seed to 80% on North Dakota seed, and the average was 36%. The second test without treatment ranged from 8% on the Winnipeg seed to 64% on the Ohio seed, and the average was 24%. The test on the seed after the first treatment ranged from 63% on the Winnipeg seed to 95% on the Montana seed, and the average was 83%. After the second treatment, the germination was practically complete and averaged 99%.

The weak and dead sprouts in all of these tests on alfalfa were few and each averaged less than 1%. No hard seeds remained after the second treatment.

Sweet Clover - As shown in Table 30, hard seeds of sweet clover were received from eight laboratories. The first test without treatment showed that there was an average of 7% germinated and in the second test without treatment the average was but 1%. The first treatment and test showed an average of 79% and the final treatments and test showed an average of 94%. The number of treatments made ranged from one to six.

As in the alfalfa, the weak and broken sprouts in this sweet clover each averaged less than 1%. The hard seeds remaining after the tests ranged from 0 to 34%.

Red Clover - Eight laboratories submitted hard seed separations of red clover seed. The results of the tests on these are given in Table 31. The average germination without treatment was 8% for the first test and 3% for the second test. After the first treatments, the average germination was 78% and after the final treatments, the average germination was 94%. The number of treatments ranged from 20 to 6 and the hard seeds ranged from 0 to 18%. The weak sprouts and dead seeds averaged less than 1%.

Alsike Clover and White Clover - Six laboratories submitted hard seeds of alsike clover and four laboratories sent in hard seeds of white clover. As shown in Table 32, the hard seeds germinated but 6% and 1% respectively for the two tests without treatment and but 62% after the first treatment and 71% after the final treatments. The number of tests ranged from 3 to 6, and the hard seeds which remained ranged from 0 to 80.

Miscellaneous Seeds - Eight kinds of legume seeds have been grouped together in Table 33. Lespedeza showed but little germination before treatment but after the first treatment the germination was 37% for the first tests and 99% after the final treatments. Korean lespedeza averaged but 2% for each test before treatment and 65% after the first treatment. Hard seeds in beans responded well to testing and treating. The germination averaged 61% and 36% respectively before treatment and 100% after the first treatment. Peas behaved much the same as beans and showed germinations of 74% and 91% respectively for the two tests before treatment and 100% after the first treatment. Tests on two lots of astragalus showed these seeds to behave something like sweet clover but gave more complete germination after treatment. Before treatment there was no germination in the first test but 13% in the second test. After treatment the first test showed 98% germination and the second treatment showed 100% germination. Sweet Peas showed 10% and 18% germination by the two tests before treatment and 86% germination after the first treatment. There were no hard seeds remaining after the first treatment but there was about 14% dead seed. Vetch showed 14% and 13% germination by the two tests before treatment. Lupines showed 2% and 9% for each of the two tests before treatment, and 90% after the first treatment.

Conclusion - It seems fair to conclude from this study that a high percentage of the legume seeds which remain hard at the end of the routine laboratory test, are viable and can safely be added to the seeds showing prompt germination and considered as "Total Live Seed".

The results of this study confirm other published results and indicate that hard seeds vary in readiness of germination without treatment somewhat as follows: Alfalfa 60; red clover and sweet clover 8; white clover 7; and alsike clover 6.

TABLE 27. - VIABILITY OF HARD SEEDS OF LEGUMES AFTER TREATMENT WITH THE ELECTRIC NEEDLE. U. S. DEPARTMENT OF AGRICULTURE

Kind of Seed	Number samples	Germination	Abnormal	Dead seeds
		%	%	%
Medicago sativa	4	89	8	3
Medicago hispida	1	98	-	2
Melilotus spp.	31	95	4	1
Trifolium incarnatum	25	95	5	-
Trifolium repens	19	86	11	3
Trifolium hybridum	3	55	30	15
Trifolium dubium	6	76	13	11
Trifolium pratense	4	85	12	3
Lespedeza sericea	3	91	2	7
Lespedeza striata	2	96	0	4
Lespedeza stipulacea	2	92	5	3
Vicia villosa	118	97	1	2

TABLE 28. - VIABILITY OF HARD SEEDS OF LEGUMES AFTER TREATMENT WITH THE ELECTRIC NEEDLE. MISSOURI LABORATORY

Kind of seed	Number samples	Strong sprouts	Abnormal sprouts	Dead seeds
		%	%	%
Korean lespedeza	167	87	9	4
Alfalfa	61	82	12	6
Red clover	91	81	12	7
Sweet clover	34	81	10	9
White clover	20	61	17	22
Alsike clover	23	65	23	12

TABLE 29. - ALFALFA. VIABILITY OF HARD SEEDS WHICH REMAINED AT END OF ROUTINE TESTING.

Laboratory and number samples represented	No treatment				First treatment and test		Second treatment and test [1]	
	First test		Second test					
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak
	%	%	%	%	%	%	%	%
Canada								
Saskatoon -57	56	0	27	0	74	0	99	1
Vancouver -18	9	0	19	0	80	0	99	0
Winnipeg - 3	10	0	8	0	63	0	100	0
Indiana	24	0	25	0	94	1	100	0
Minnesota -61	41	0	11	0	92	0	99	1
Missouri -54	51	0	22	0	93	2	99	0
Montana -718	41	0	12	0	95	4	99	1
North Dakota-13	80	0	26	0	73	0	100	0
Ohio	12	0	64	0	86	0	100	0
Average	36	0	24	0	83	0	99	0

1. No hard seeds remained at the end of test after second treatment.

TABLE 30. - SWEET CLOVER. VIABILITY OF HARD SEEDS WHICH REMAINED AT END OF ROUTINE TESTS

Laboratory and number samples represented	No treatment				First treatment & test		Final treatments & tests [1]		Hard seeds remaining
	First test		Second test						
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	
	%	%	%	%	%	%	%	%	%
Canada									
Winnipeg - 2	3	0	0	0	76	0	100	0	0
Indiana	8	0	0	0	100	0	-	-	0
Minnesota - 33	6	0	1	0	87	1	99	0	0
Missouri - 24	2	0	1	0	94	2	98	0	2
Montana -253	7	0	2	0	94	1	65	1	34
N.Dakota - 46	4	0	1	0	94	1	96	1	3
Ohio -	2	0	3	0	89	0	95	0	0
U.S.Dept of Agri 903465	0	0	0	0	66	1	97	0	2
Melilotus alba	24	0	0	0	81	0	100	0	0
Melilotus spp.-41	6	0	1	0	96	0	94	0	1
Average	7	0	1	0	79	0	94	0	4

1. Number of treatments given: Canada - Winnipeg 2, Indiana 1, Minnesota 4, Missouri 5, Montana 6, N. Dakota 4, Ohio 3, U.S. Dept of Agri. No.903465 5, Melilotus alba 2, Melilotus spp. 6.

TABLE 31. - RED CLOVER. VIABILITY OF HARD SEEDS WHICH REMAINED AT THE END OF ROUTINE TESTS.

Laboratory and number samples represented	No Treatment				First treatment and test		Final treatments and tests 1		Hard seeds remaining
	First test		Second test						
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	
	%	%	%	%	%	%	%	%	%
Canada									
Sackville	13	0	3	0	87	0	98	0	0
Vancouver -15	8	0	5	0	77	0	99	0	0
Winnipeg - 4	5	0	1	0	91	0	98	0	0
Indiana	4	0	3	0	91	0	100	0	0
Minnesota -17	12	0	3	0	51	0	98	0	1
Missouri -95	7	0	1	0	74	1	86	0	14
Montana -122	9	0	2	0	81	0	95	0	4
Ohio	3	0	3	0	75	0	80	0	18
Average	8	0	3	0	78	0	94	0	5

1. Number of treatments given: Canada - Sackville 5, Vancouver 3, Winnipeg 2, Indiana 2, Minnesota 6, Missouri 5, Montana 6, Ohio 5.

TABLE 32.- ALSIKE CLOVER AND WHITE CLOVER. VIABILITY OF HARD SEEDS WHICH REMAINED AT END OF ROUTINE TESTS.

Laboratory and number samples represented	No Treatment				First treatment and test		Final treatments and tests[1,2]		Hard seeds remaining
	First test		Second test						
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	
	%	%	%	%	%	%	%	%	%
Alsike Clover									
Canada									
Sackville	8	0	2	0	57	0	98	0	1
Winnipeg - 1	10	0	0	0	59	0	100	0	0
Indiana	2	0	1	0	76	0	59	0	41
Minnesota -10	7	0	2	0	54	0	94	0	5
Montana -64	8	0	2	0	44	0	37	0	63
Ohio - 4	1	0	1	0	59	0	40	0	59
Average	6	0	1	0	62	0	71	0	28
White Clover									
Winnipeg - 1	10	0	5	0	50	0	100	0	0
Indiana	8	0	2	0	40	0	20	0	80
Montana -20	5	0	1	0	42	0	27	0	72
Ohio	5	0	1	0	33	0	20	0	80
Average	7	0	2	0	41	0	42	0	58

1. Number of treatments given - Alsike Clover: Canada - Winnipeg 2, Sackville 6; Indiana 3, Minnesota 6, Montana 6, Ohio 5.
2. Number of treatments given - White Clover: Winnipeg 3, Indiana 3, Montana 6, Ohio 5.

TABLE 33. - MISCELLANEOUS SEEDS. VIABILITY OF HARD SEEDS WHICH REMAINED AT END OF ROUTINE TESTS.

Laboratory and number samples represented	No Treatment				First treatment and test		Final treatments and tests[1]		Hard seeds remaining
	First test		Second test						
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	
	%	%	%	%	%	%	%	%	%
Lespedeza									
U.S.Dept. of Agr. - 3	1	0	2	0	37	0	99	0	0
Korean Lespedeza									
Missouri -71	2	0	2	0	65	1	68	0	32
Beans									
Montana -10	61	0	36	0	100	0	-	-	0
Peas									
Montana -25	74	0	91	0	100	0	-	-	0
Astragalus									
Montana - 2	0	0	13	0	98	0	100	0	0
Sweet Peas									
Montana - 9	10	0	18	0	86	0	-	-	0
Vetch									
U.S.Dept.of Agri. -59	10	0	3	0	76	1	99	0	1
Ohio	17	0	24	0	76	0	99	0	0
Average	14	0	13	0					
Lupinus Luteus									
U.S.Dept.Agri-2	2	0	9	0	96	0	98		2

1. Number of treatments given: Lespedeza - U.S.Dept.of Agri. 4, Korean Lespedeza - Missouri 4, Beans - Montana 1, Peas - Montana 1, Astragalus - Montana 2, Sweet Peas Montana 1, Vetch - Ohio 3, Lupinus luteus - U.S. Dept. of Agri. 4.

Sub-Committee on Seed Sanitation

W. F. Crosier

The investigations of this group have been restricted to a study of the pathogenicity of two fungi to germinating peas and the value of certain chemicals in reducing infection by these micro-organisms. The fungi involved, Rhizoctonia solani Kuhn and Sclerotinia sclerotiorum (Lib.) Massee are infrequent associates of seed peas and were observed to severly injure sprouts in untreated tests. A quantity of infected seeds were air-dried and in part treated with cuprous oxide or Ceresan (two per cent ethyl mercuric chloride). Seeds of the varieties Chief, Thomas Laxton and Winner were also treated with these dusts. The five members of the sub-committee conducted the germination tests under very similar conditions and in general reported similar findings.

The study demonstrated that Rhizoctonia solani when present in, or on, five per cent of peas may infect the adjacent seeds and sprouts and interfere with the appraisal of the seedstock.

Many of the untreated seeds were injured before, or simultaneously with, initiation of germination so that they appeared not to be viable and would have been recorded as dead.

The severity of infection was greater in eight-day than in six-day tests probably due to the increased spread of the mycelium. Either cuprous oxide or Ceresan applied only to the inocula increased the percentage of healthy sprouts. Dusting the seeds but not the mummified peas reduced the percentage of infection but usually less than did chemical treatment of the inocula alone. When either chemical was applied to both seeds and mummies, as would occur in commercial treating, the apparent germination closely approximated that of the non-inoculated controls.

Sclerotinia sclerotiorum is an infrequent associate of pea seed. The mycelium arising from only one infected pea may destroy one-half of the seedlings in a 100-seed test. In experiments with Thomas Laxton and Winner varieties of peas non-protected seeds were seriously injured. Application of cuprous oxide to the seeds alone did not inhibit spread of the mycelium. Ceresan, however, partially protected the sprouts even though applied only to the seeds. When both seeds and mummies were treated with Ceresan very accurate germination readings were secured. Cuprous oxide was noticeably less efficient.

The data supplied by the individual laboratories agreed very closely. Varying the supply of water with the tests at Geneva caused a greater variation among replicates of any one treatment than was reported for the identical replicates distributed to the various members.

The results from any one or all laboratories taken collectively indicate, that Rhizoctonia solani and Sclerotinia sclerotiorum destroy many seeds and sprouts in untreated germination tests and thus reduce the accuracy of the readings, that applications of cuprous oxide and Ceresan decrease infections, and expedite reading of the tests and that the fungi cause greater injury in eight than in six-day tests.

Sub-committee on Revision of Rules

E. H. Toole

Our revised rules have only recently been put into force, therefore one would not expect much activity of this committee. However, the committee has

been continued by the Association with the idea that it might serve as a clearing house for suggestions as to desirable changes. The committee are disappointed that only one communication has been received. It is realized that this does not mean that no amplification of the rules is needed or that all members of the association are satisfied with the present wording of the rules.

Probably the greatest need at present is for clarification of definitions and especially for more detailed definitions. The proposal of detailed definitions should and will lead to much discussion. In most instances there is equal reason for any of several possible definitions, but in the interest of definiteness it is desirable to make a definite selection of these definitions. On the other hand, we must remember that definitions will not obviate the need of judgment in their application where definite lines of separation between classes do not exist.

Mr. Edgar Brown has made some definite suggestions concerning chalcis fly and nematode injury of clover seed and ergot of Paspalum, He suggests: "With ergot of Paspalum there are all stages of deformity and it does not seem practicable to separate the ergotized seeds from those which are not. It therefore seems necessary to consider all seeds without reference to this condition as pure seed. The same procedure would seem to be indicated with respect to seeds infested by nematodes."

Mr. Brown's suggestion with respect to chalcis-fly-infested clover seeds may be summarized as follows: In many cases the cotyledons are entirely gone, leaving only the seed coats which would be removed by adequate cleaning and which are liable to be destroyed in handling. Other infested seeds may be eaten so little that their specific gravity is changed only slightly. These latter seeds evidently would be placed with pure seed under our rules. Where can a line be drawn? Is a standard blowing practicable? Are the empty seed coats really a factor in analyses?

This committee recognized the need of clarification of these points but feels that more information is needed about the actual conditions encountered in handling these seeds.

Mr. Kercheval E. Smith in his report of the Seed Testing Committee of the American Seed Trade Association at the 1939 convention stresses the need of definitions of "live seed" and live pure seed". This committee feels that these are terms for legal definition rather than definition in our rules. However, it might be desirable for this Association to suggest definitions of these and other terms. Mr. Smith also comments on interpretational difficulties with the present definition of weed seed. This is an important problem, and all phases of it should be thoroughly discussed by those analysts having actual experience with it.

A year ago this committee suggested a tentative tolerance for noxious weed seeds for trial and criticism. We have received no comments about this tolerance, but we hope that it will be discussed at the coming meeting. There is need for such a tolerance. If the proposed form is not workable in practice, what are the difficulties?

The committee recommends that the proposed tolerance for noxious weed seed be adopted as a part of the rules, with the understanding that such tolerance be not used where a minimum or maximum limit is established by law or regulation.

The definite recommendations incorporated in our rules for the germination of specific seeds should be, and in general are, based on long experience, and the procedure for such seeds is fairly well established. Many seeds, less frequently encountered, have not been studied enough for a basis for definite recommendations.

It is suggested that for such seeds a list of provisional recommendations be prepared based on available information. When the rules committee feels that sufficient research has been conducted on a wide range of samples to justify a definite recommendation, such recommendation should be added to the rules. In the meantime this provisional list would suggest research problems to interested analysts.

Sub-committee on the Hand Book

E. Brown

No formal report has been included with this general report since this meeting is centered largely on discussions of the papers submitted by the hand book sub-committee which constitute that committee's report.

A communication was received from Miss Kanipe outlining the problem regarding Chalcis fly and similar types of injury referred to in the report of the Sub-committee on Revision of Rules, with the suggestion that a study of the problem be initiated by the Research Committee. It was received too late for the past season's activities but this Committee recommends that the technique for the analysis of samples injured by Chalcis fly be studied during the coming year by the Sub-committee on Analysis of Small Seeds.

In conclusion, I would like to express my sincere appreciation of the very active work of the various sub-committees whose reports have been read. The various chairmen and their co-workers are to be congratulated on the thoroughness and careful thought they have put into their work and it is evident that a great deal of worthwhile information has been secured. Each one of the projects being studied is, in my opinion, of importance. None of them are yet complete and I recommend that they be continued and possibly extended.

It is regretted that general referee tests for the Association as a whole have not been initiated this year. I had intended assuming this responsibility but circumstances were such that this became impossible. Nevertheless, I believe that they are a valuable feature of our work and that they ought to be continued.

May I close on a note of appreciation of the work of my predecessor, Dr. Porter, in the chair of this committee. The excellent organization which was in effect when I became chairman has greatly facilitated my work. It has been continued on the same lines and with much the same personnel and extended somewhat to include one or two further projects.

Finally, may I express my thanks for having had this opportunity of serving the Association again. - C. W. Leggatt, Chairman.

REPORT OF MEETING OF THE SEED COUNCIL OF NORTH AMERICA

Chicago, Ill., November 30, 1938

A. L. Stone

State Department Agriculture, Madison, Wis.

Mr. Stone, who has been Secretary-Treasurer of the Council and the representative of the Association of Official Seed Analysts, presented a report of the above

meeting which was given over to discussions of Federal seed legislation and the general weed problems of the United States.

THE NEW FEDERAL SEED ACT

Fred W. Kellogg

Kellogg Seed Co., Milwaukee, Wis.

Mr. Kellogg discussed the history of the Coffee Bill and the relation of Federal seed legislation to the Seed Trade in an address that has been published in full elsewhere. See, Seed World 46(5): 5-7. 1939.

SEED LAW ENFORCEMENT IN ILLINOIS.

L. A. Moore

State Department of Agriculture, Springfield, Ill.

At the invitation of our program committee, the salient features of the Illinois seed law enforcement program are to be presented. The word "program" is used advisedly because there is a definite coordination of all agencies, functions, and processes pertaining to law enforcement.

The Illinois Seed Law.

The successful administration of any program rests upon a well founded policy, therefore a brief presentation of the Illinois seed law and the policy of the Illinois Division of Seed Inspection is pertinent to the subject.

Just twenty years ago, the Illinois seed law was enacted. At that time Illinois was said to be the dumping ground for seed not wanted elsewhere. Sponsored by farm organizations, but strongly opposed by certain interests, the law as enacted was deficient in most of the important provisions especially those essential to efficient enforcement. With the support of the Illinois seed trade and other interested organizations the law has been amended until now it stands not as an example of perfection but one that is comprehensive and capable of efficient enforcement. It is sung that "God moves in ways mysterious his wonders to perform" but so do some State legislatures.

For example, the Division of Seed Inspection may seize or impound a whole train load of seed if found to be misrepresented but there is no provision for its disposal. An amendment submitted to the last legislature to provide such means was like my last horse, he failed to get a call. After passing the Senate in record time, the bill failed to get a call for last reading in the House. However, we shall continue to seize seed and let the claimant sue for it in a court of competent jurisdiction if he chooses, but callous indeed is the vendor who will choose the bright light of publicity to the amicable compliance with the seed law.

To attain the objectives of all seed legislation which are, the protection of the purchaser against fraud and deception; to secure a basis for fair competition among dealers and to reduce the dissemination of noxious weed seed through agricultural seed, certain provisions are essential. In addition to the labeling provisions, common to all State seed laws, the Illinois law has three

provisions which contribute to the attainment of those worthy objectives:

1. The sale of agricultural seed containing noxious weed seed in excess of the certain tolerances provided is prohibited.

2. Authority is not only granted but its exercise is mandatory, to seize or impound agricultural seeds sold, offered, or exposed for sale for seeding purposes if they appear to violate any of the provisions of the seed law.

3. Farmers are not exempt.

Only 15 State seed laws contain prohibitory provisions, only a few permit seizure and only 1 requires full farmer compliance. If seed laws are to reduce the widespread dissemination of noxious weed seeds, prohibitions are necessary. If enforcement is to be efficient, seizure and prompt action is essential and if the seed trade is to be given a basis for fair competition, farmers who sell seed for seeding purposes must not be exempted. The exemption of farmers is certainly not consistent with either the objectives nor with just legislation. Such an exemption is class legislation and is contrary to the Constitution of Illinois. To regulate the recognized seed trade and at the same time submit it to the ruinous competition of itinerant truckers, seed pirates, "curbstoners" and over the fence traders is penalizing a highly technical and specialized service that is essential to our modern agriculture. The rapid and widespread distribution of some of our worst noxious weeds is evidence of the need of rigid enforcement of seed and weed laws and of more than mere "lip service" to their objectives.

Just a few years ago Illinois was being flooded with cheap, mail order seed, selected thru catalogues bearing eloquent testimony of their worth. Farmers in search of something new in bargains and varieties got them in the form of hoary cress, field bindweed, leafy spurge, and other noxious weeds that will be trying their souls and pocket books for many years. It is reported that one southern Illinois trucker made a net profit of $4,000.00 in one season with an old truck, hauling dodder infested lespedeza into Illinois from southern States. An undertaker who found people of his community too healthy for profit made a practice of pooling orders for seed at bargain prices, thereby making an "honest penny" for himself. But few farmers knew of the seed law at all and fewer knew of their responsibilities as vendors. In fifteen years, only one offender faced a court, and that a federal court for violating the State and Federal seed laws. These examples represent the conditions facing the Illinois seed dealers and others who did business in Illinois. Obviously, such conditions called for a firm policy and a vigorous enforcement program.

Policy

With the aid of the Illinois Seed Dealers' Association, such a policy was formulated. It is based upon the assumption that laws are enacted in the interests of the general welfare and in that respect the seed laws are not exceptions. The primary objectives appeal to the highest ethics in business relationship and their attainment is a distinctive service to agriculture which is the goal for which all conscientious seedsmen and enforcement officers strive. Enforcement is based upon the philosophy that this is "a government of laws and not of men". Neither the enforcement officer, the division inspectors, nor any other official other than one of the judiciary has a constitutional right to interpret or to interfere with law enforcement. The interpretation of the law and the adjudication of guilt or innocence of its violation is for the courts to decide and not for other individuals particularly prosecuting attorneys. In other words,

there is no kangaroo court, no promises of leniency and no probation. The law is applied to the kings and princes as well as to the man with the hoe. Through news releases, exhibits, radio broadcasts, scheduled meetings, and personal contacts, the public and the seed trade were informed of the policy of the Division of Seed Inspection. To maintain a firm and steadfast policy has required diligent effort but nothing will destroy the confidence of the seed dealers nor cause adverse public opinion more surely than a vacillating policy. Without the support of a confident seed trade and favorable public opinion, seed law enforcement would be demoralized in a few weeks if not in a few days.

Law Enforcement.

To seed law enforcement, an adequately equipped laboratory, manned by competent analysts, is indispensable. Service must be prompt, lest the result of the purity analysis and germination test is known too late to prevent damage. But, without thorough and efficient inspection, the work of the best seed laboratory may be almost nullified.

The backbone of law enforcement is thorough and competent inspection. Without it but little enforcement could be accomplished. Further, unless the inspection staff is given proper administrative support, there is little that can be accomplished. Efficient enforcement requires a high degree of coordination between the laboratory and the inspection staff and the active support of the administrative officer.

The ideal inspector would be a blend between a perfect policeman and a seed analyst of superior ability. Honesty, courage and all the virtues that go to make a man of character should be possessed in a high degree. An inspector must be diligent; he must be able to assume responsibility; he must possess excellent judgment and be adapted to a strenuous life on the road. With all these attributes, unless he knows seed he is practically useless as an inspector.

The Illinois inspection staff consists of four regular inspectors but upon occasion men of the analytical staff are detailed as additional inspectors. Each inspector is an appointee of the Illinois Civil Service Commission and has received at least one year's training in the laboratory as an analyst before his appointment as an inspector. While we do not boast of perfection we claim that these men who serve as inspectors possess the desirable attributes to a high degree. Each is responsible for seed law enforcement in a large section of Illinois. Their achievements testify to their industry, diligence and resourcefulness. The average yearly mileage traveled by each inspector in line of duty approaches 40,000 miles. Thousands of inspections are made. It is only when doubt exists or a violation is obvious that an official sample is taken. Consequently the laboratory is spared the time and energy of making many unnecessary analyses. Only about 400 official samples are taken yearly. The dealer or wholesaler only is advised of the finding of the Illinois seed laboratory. The Division is authorized to publish such finding at its descretion, but it has let it be known that it is contrary to its policy to furnish sales talk to seed salesmen who have more to say about their competitors' seed than they know about their own. Laboratory records are open to inspection as public documents but no transcripts are permitted. Samples are taken in freight houses, warehouses, storerooms, from trucks and anywhere that seed may be found. In each case the vendor is promptly notified and a sealed duplicate sample is forwarded to him. A red tag on which is printed a "Stop Sale Order" is sealed on the container.

In a few instances, it has been necessary for inspectors to seize and impound seed to be released only after it has been cleaned to comply with the provisions of the Illinois Seed Law. With such authority granted them, you can readily understand why it is necessary for inspectors to be well trained. Irreparable harm might be done not only to the vendor but to the farmer or purchaser as well.

Problems of Law Enforcement.

Mail order seed may be as good as any, but often it is seed of the poorest quality. Attracted by colorful advertising, ambiguous and extravagant statements and the low prices quoted, farmers are lead to purchase, not the superior but the lowest priced grades. Companies of other States shipping such seed into Illinois evaded the Federal Seed Act by not labelling purity or germination at all and of course were beyond the jurisdiction of the Illinois law. After appeals to the companies to cease such practices had failed, it was necessary to bring all available pressure on the purchaser. Inspectors were assigned to the freight houses at transfer points where the carlot shipment is broken down to be carried by local freight to the destination. Any seed consigned to an Illinois address is examined, if doubt exists an official sample in taken, and a "Stop Sale Order" is attached to the bag and a letter addressed to the consignee by the inspector, telling him to wait for an analysis before he sows the seed, is mailed that night.

Sometimes the shipments going through the transfer freight houses are too numerous for the inspector to take samples. In such instances, he gets the name and address of the consignee and forwards it to the office. Letters or telegrams are promptly sent to the consignee ordering him to hold the seed for inspection.

Other railroad and transportation agencies cooperate by causing their local agents to wire the office of the Division of Seed Inspection upon the receipt of any seed. Again the consignee is advised to hold the seed for inspection.

Most farmers are glad to be advised of the quality and so express themselves especially when it is known that the seed contains Canada thistle making him liable to a fine from $10.00 to $100.00 under the Criminal Code for bringing Canada thistle seed into the State. The analysis of that portion of the sample mailed to the laboratory is usually completed the day it is received so the purity report most often reaches the consignee by the time the shipment arrives. A letter is enclosed advising him as to disposal, if the seed fails to comply with the Illinois law. Some farmers are like Kipling's recruit "E don't obey no orders unless they is 'is own". The only answer to such a recalcitrant is a warrant and a visit to the judge who has never failed to assess a fine, most often the maximum. News travels and soon the whole county knows the prosecution and the element of fear becomes one of our faithful allies.

This, with other inspection, taxes the entire Division to the limits of its capacity but there is abundant proof that this phase of the program has been effective.

Seed Pirates present a different problem. They have no permanency and are in and out of the seed business in a comparatively short time. They seek not to serve agriculture but an "honest penny". Most often they are men of some means and some standing in the communities with a wide acquaintance among farmers. They are of the old horse trader type and often use seed as an instrument of barter. Their apprehension is difficult. They seldom have seed in their possession even when they offer it for sale. Broker like, they just order delivery between their clients and take their commission even if they take it in pork or

eggs. Through contacts with the local seed dealers, farm advisers, members of the county seed and weed control council and local police officers, their activities are learned of. When apprehended, they believe themselves to be too powerful to be convicted in their communities and often through fear of political reprisal prosecutors fear them. The only recourse is sizzling publicity which has not failed thus far. Imagine a prosecutor refusing to file an information against a wilful and habitual violator because of his reputation as a Christian and of personal friendships. The long cloak of piety was rudely stripped from him through publicity and out stepped the devil. The prosecutor is now capitalizing on the courage he displayed in prosecuting the biggest man in the town.

The curbstoner seeks his honest penny in the same way as the seed pirate except that he has no money. He just knows where the seed is. In court he usually is a good witness for the prosecution and the information he furnishes often leads to prosecution of a farmer violation.

Sale barns and public auctions have menaced law enforcement but because of the advertising entailed they can be regulated. The auctioneer is held responsible as the agent in the transaction and it is seldom that seed is sold in violation of the law without information reaching the office. Courts have held that statements such as "The contents of this bag are said to be clover seed, you are buying the stuff for what it is" etc., is selling seed for seeding purposes. Seed sold as feed at bargain seed prices has been seized and the act upheld by the courts.

Itinerant truckers came with the good highways. They are active particularly in southern Illinois. Again, the allies of the Division of Seed Inspection are the local dealers, farm advisers and more recently the local farmer who has seed for sale. Sheriffs, constables, State police, seed inspectors, and others apprehend them on suspicion.

Trucks and cargoes have been held and the driver reposed in jail for twenty four hours while an official sample sent by special messenger to the laboratory was analyzed as evidence. Judges have assessed and collected heavy fines against violators. It has been reported by many that the business of the trucker seedsman has ceased to be profitable in Illinois. To match wits with some of them has been a serious but entertaining experience. To leave a warm hotel bed on a chilly February night to meet a three o'clock ferry, 20 miles away, presents another phase of the experience but it has been done. It is part of the inspector's job.

The unscrupulous dealer is rare in Illinois and can easily be identified. He is never a member of the Illinois Seed Dealers' Association because of the differences in ethical codes. Service to agriculture is foreign to him and to take advantage of a competitor through sharp practice is his selfish pleasure. He merits and receives the contempt of the seed trade. He exists for a time only because of the credulity of some farmers. To the Division of Seed Inspection, he is cancerous and something to be rid of. He is kept under close surveillance. One such dealer recently opened a store room. Within three weeks all of his seed was impounded. He was arrested, spent a night in jail because of failure to give bond and upon a plea of guilty, asking mercy of the court, he was fined the maximum on six counts, or $600.00 and costs. Dealers know the seed laws and the old policy of giving wilful and repeated offenders a slap on the wrist has given way to a "knockout".

Farmer to farmer sales present the most difficult of enforcement problems. Of all unregulated competition of the seed trade, they are the most serious. As vendors of uncleaned seed, farmers are the worst offenders to weed control.

As vendors of mixed varieties they have done much to lower the grade and quality of their products. That such sales should be regulated in unquestioned.

Through numerous night schools, and other types of educational meetings, farmers have been advised of their responsibilities under the seed law. They all believe that they should be regulated. Canvasses made at such meetings indicated that they wanted only pure seed and that they made use of custom cleaners even at considerable expense and effort to make their home grown seed fit for seeding. To meet such groups and see the enthusiasm expressed might lead one to optimistic conclusions. However, those in charge know that those groups represent only about 25% of the farmers and that the remaining 75% are less progressive, and are more indifferent. Then the magnitude of the problem appears.

Apprehension is difficult. By taking samples from seeders, inspectors have unearthed many violations which were promptly prosecuted. The practice of taking seeder samples is part of the routine work of inspection. Neighborhood gossip furnishes many clues which have lead to arrests and prosecutions. Wide publicity was given such action but just what the "batting" average is no one can say. This much can be said that such acts met with the approval of the farmers in the community. The great increase in the use of the seed laboratory by farmers, the number of inquiries relative to labelling requirements, the increase in business reported by custom cleaners and the increase in number of cleaning machines indicate that progress is being made.

To ascertain certain facts about the sources of seed used on farms, 13,000 questionaires were mailed to high school students of vocational agriculture. Only part of the data has been tabulated but thus far it shows that about 12% of all seeds used on farms passes through the regular seed channels. Less than 60% of all small seeds passed through those channels. Hybrid corn excepted, about 5% of the cereal crops and large seeded legumes passed through those channels. An encouraging point is the high percentage of the seed of cereal crops that was produced at home and the surprising percentage that was reported cleaned before seeding. These reports are made on a year of very heavy production of the clovers in Illinois, and cannot be taken to represent averages. The results of the survey will be distributed as soon as tabulations are completed. It is anticipated that the survey will be repeated next year and in time it is possible to know more about enforcement than is now known. Now, only diligent effort, no matter how strenuous, can be expected.

If the Illinois Division of Seed Inspection has achieved some measure of success in seed law enforcement, it is in a large measure due to the cooperation of the organized seed trade and other interested agencies and to the courage, fidelity, and ability of the inspectors.

Success gives ambition and courage to go on; from failures something is learned; what remains to be done is a challenge to the best thought and most earnest endeavor.

A SUGGESTED POLICY FOR THE EVALUATION OF HARD SEEDS[1]

W. O. Whitcomb

Agricultural Experiment Station
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When we think of present-day problems in the interpretation of the plant-producing value of hard seeds as we observe them in the laboratory, we do well to recognize that this is a problem of long standing. Nobbe (28)[2], in Germany, suggested in 1876 that this condition was caused by a waxy coating over the seeds. In 1894, Michalowski (25), also of Germany, perfected a machine which was designed to scratch the surface of the seeds in bulk lots in such a way as to cause the hard seeds to germinate as readily as the others. Some three years later, Rostrup (32) in Denmark, was experimenting with the treatment of these seeds with sulphuric acid for the same purpose.

Influence of Early Work

This pioneer work with impermeable seeds of legumes paved the way for much of the experimental work which was to follow. As early as 1909, and continuing for the next seven years, Harrington (10) studied the behavior of hard seeds in alfalfa and the clovers. In 1912, Love and Leighty (21) in New York published the results of their experiments with sulphuric acid to cause hard seeds to germinate, and in the same year, Stevens and Campbell (38) in North Dakota reported results of treating red clover and alfalfa with a number of different kinds of chemicals for the same purpose. By 1914, Duggar and Tisdale (4), in Alabama, were advocating the boiling of the seeds of bur clover in water for 20 minutes to cause them to germinate for commercial field planting, while Whitlock (as reported by Whitcomb) (42), in Montana, was studying the field germination and crop yields of alfalfa and the clovers when the seeds were treated with sulphuric acid. Hughes (13), in Iowa, invented a scratching machine in 1915 called a "scarifier", which proved to be a very effective device for rendering hard seeds permeable and was largely used commercially.

Much of this early work and that which followed has pointed the way in the interpretation of the plant-producing value of hard seeds. As a result we are now attempting to formulate "A Policy for the Evaluation of Hard Seeds."

Review of Hard Seed Investigations and Interpretation of Seed Value

The problem of evaluating hard seeds has received attention by many investigators during the past 25 years or more, and a review of this work is presented as a foundation on which to base a suggested policy.

As early as 1912, according to Pammer and Schindler (29), the Union Agricultural Experiment Stations, in Germany, required that hard seeds must be stated separately from the germination, and in 1913, the testbook of the Austrian Union of Agricultural Experiment Stations prescribed that 1/2 of the hard seeds of alfalfa and 1/3 of those of the clovers should be added to the germination.

The interpretation of the plant-producing value of hard seeds was first undertaken in America by Harrington (11) of the U. S. Department of Agriculture

1. Contribution from Montana State College, Agricultural Experiment Station. Paper No. 136, Journal Series.
2. Numbers in parentheses refer to Literature Cited.

in 1916, at which time he made the following recommendations: (1) For red clover, alsike clover, white clover, and sweet clover, when seeding late in the spring, add 1/10 of the hard seed to the percentage of germination; but when seeding late in the fall, winter, or early spring, add all hard seeds to the germination. (2) For alfalfa and crimson clover, add 2/3 of the hard seeds to the germination under all conditions.

In 1921 and the years immediately following, considerable work in the interpretation of the value of hard seeds was done. In this year, Lunz (22) suggested adding 1/2 of the hard seeds to the germination, or if not more than 20% hard seeds, add all of them to the germination. Also in 1921, French (7) made a survey of how the various seed testing laboratories were reporting the results of tests in which ard seeds were found, and reported that the 27 laboratories which made replies, 21 did not count hard seeds as germinated, one counted all as germinated, one 2/3 as germinated, and one 6/10 as viable but listed them separately.

Whitcomb (40), who began work in Montana in 1921, separated hard seeds of alfalfa, sweet clover, and red clover from the permeable seeds by means of subjecting lots of seeds to germination conditions in blotters for seven days. These were tested in the laboratory and in pots set in soil in the field with the following results:

Kind	Laboratory		Field	
	Germination	Hard Seeds	Germination	Hard Seeds
	%	%	%	%
Alfalfa	40	58	28	1
Sweet Clover	1	96	4	82
Red Clover	8	92	13	56

From these results, he concluded that during the first year alfalfa had the greatest value for the hard seeds (30 to 50%), red clover next (15 to 25%), and sweet clover least (10 to 15%).

In 1921, Lute (23), in Colorado, collected hard seeds from numerous six-day laboratory tests of alfalfa and tested them in the laboratory and in the field. The results in the laboratory were 8.5% germination and 91.5% hard seeds, in five days, while those in the field were 17.96% plants in two months. Four varieties of alfalfa seed which had received no treatment averaged 75.5% germination with 19.0% hard seeds in the 5-day laboratory test and produced an average of 29.21% plants in the field in two months. From these results, she concluded that some impermeable seeds of alfalfa get into the field stand and that seed that fails to come up in two months fail to get into this stand.

In New York, in the same year, Hopkins (12) made a number of various kinds of tests with hard seeds. In one of these the seeds were placed in water at room temperature for seven months, during which time the total germination was as follows: - alfalfa, 62.50%; red clover, 38.46%; sweet clover, 29.41%; and alsike clover 10.25%. As a result of these studies, she recommended that the analyst report the percentage of actual germination and in addition report the percentage of hard seeds.

Since 1924, there has been another period of activity in hard seed investigations. The germination of hard seeds of alfalfa and sweet clover as the season advances was studied by Whitcomb (42) in 1924. He used 17 lots of each kind of hard seed and tested them in laboratory, greenhouse, and field. During the first two weeks, the germination results were as follows: Alfalfa,17%,20%, and 50%; and sweet clover, 2%, 2%, and 1% for each of the three places. During the second two

weeks, the additional germinations were: Alfalfa, 7%, 3%, and 30%; and sweet clover, 4%, 3%, and 3%. The conclusion which was drawn from this study was that the hard seeds of sweet clover should be given a much lower rating in plant-producing value than those of alfalfa.

During the years 1924 to 1927, Schmidt (33,34,35,36,37) studied the behavior of hard seeds under Wisconsin conditions and as a result made the following tentative recommendations for planting: (1) fall or early winter for sweet clover with over 70% hard seeds, (2) late winter or early spring for red clover, white clover, alsike clover, alfalfa, and sweet clover with 20 to 60% hard seeds, and (3) late spring for alfalfa, alsike clover, red clover, and sweet clover with few hard seeds.

Stevens and Long (39) reported in 1926 that North Dakota white sweet clover was normally impermeable to water and retained that condition for a number of years in a dry storage, while that which was immature contained no hard seeds and had a possible germination of 15%, and those which were partly mature had 75% hard seed and 16% germination. These results compare favorable with those reported by Whitcomb (40) in 1921 for alfalfa and sweet clover.

In 1928, Lute (24) reported observations and results of experiments in Colorado having to do with hard seeds in alfalfa during the period 1919 to 1927. These results are summarized as follows:

1. Hardy varieties of alfalfa have a higher percentage of hard seeds than do the less hardy ones.
2. There was no consistent relationship between altitude and the production of hard seeds.
3. One-half of the hard seeds of alfalfa became permeable during the first 3-1/2 years of storage.
4. Dry heat at 80°C for two hours decreased the percentage of hard seeds in alfalfa and increased the germination.

In 1931, Whitcomb (43) summarized the work which had been done in Montana up to 1928 and made the following statement: "The laboratory and field trials to test the influence of hard seed content on germination seem to indicate that, even though it has a rather marked influence on the number of sprouts produced in the laboratory in tests lasting from 7 to 60 days, the hard seed content has but little effect on the plant-producing power of the seed in the field, except to a limited degree in sweet clover, red clover, and alsike clover. Leguminous seed which contains appreciable amounts of hard seeds is seldom benefited by scarifying, except sweet clover which is in the hull or which contains more than 50% hard seeds". It was concluded that this work warranted the continuation of the recommendations of the Association of Official Seed Analysts as made in 1921.

Korean lespedeza was studied as to the behavior of its hard seed by Middleton (26). He concluded that the deduction of 15% of the hard seed, as determined in the fall, is a safe estimate of the actual germination that may be obtained the following spring, and that germination plus hard seeds is a more reliable guide to the agricultural value of the seed than is germination alone.

In 1938, Erickson and Porter (6) published the results of laboratory and field tests with a number of legume crops in Iowa for the period of 1934 to 1937, and concluded with the following statement: "The work of other investigators, coupled with the results herein reported, indicate that impermeable seeds of alfalfa should be considered as practically equal to viable, permeable seeds. Impermeable seeds of red clover and sweet clover may be taken to have 15 to 50% as much value as viable permeable seeds."

Storage experiments with smooth vetch (Vicia villosa Roth.) by Dunn (5) in Oregon led him to the conclusion that probably the majority of hard seeds of this species will germinate and produce plants within the first two or three months after planting.

In 1937, Whitcomb (44) presented the results of correlation of laboratory and field germination obtained with alfalfa, sweet clover, red clover, alsike clover, and white clover which were obtained from the seed testing laboratories of Minnesota, Wisconsin, North Dakota, Iowa, and Montana. The laboratory tests were continued for six days while those in the field ran for seven weeks. By means of the correlation table, it was shown how the relationship between the laboratory germination and the plants produced in the field was affected by adding varying amounts of the hard seeds to the laboratory germination. The results of this study were summarized in part as follows:

1. When all the hard seeds were added, alfalfa and red clover were the only ones in which the coefficients were not significantly reduced.
2. When half the hard seeds were added, the coefficients compared well with those without the hard seeds for two lots of alfalfa, two lots of sweet clover, three lots of red clover, and one lot each of alsike clover, and red clover.
3. Half the hard seeds may safely be added to the laboratory germination of alfalfa, red clover, alsike clover, white clover, and to certain lots of sweet clover.
4. All the hard seeds should not be added to the laboratory germination, except in certain lots of alfalfa and red clover.

Not until recently have the hard seeds of the large-seeded legumes received attention. Much of this work has been done in New York. In 1932, Glover (8) reported that hardshell in sweet peas ranged from 0 to 97%, in field peas from 0 to 82%, and in beans from 0 to 70%.

In 1937, Patrick and Crosier (30) studied the commercial significance of hard seeds in peas and found that certain varieties were characteristically hard. Among these were Wisconsin Early Sweet, Surprise, and Early Perfectah. Special laboratory tests of these hard seeds showed that some of the seeds remained hard at the end of 18 days. When tested in greenhouse soil, it was found that there was some delayed emergence due to hard seeds. It was noted that canning pea producers do not want hard-seeded varieties because a delay of a week in emergence of seedlings means an uneven maturing crop.

The following year, Crosier and Patrick (3) studied the influence of storage on hard seeds in peas and beans and also tried various treatments to improve hard seed germination. They observed no marked change in any variety due to storage. Mechanical shaking was also ineffective, while the chemical treatments were fairly effective. Row tests in the field showed a definite lack of uniformity of plants produced from the selected hard seeds.

Work on hard seeds in Canada was begun by Leggatt (16,17,18,19,20) in Alberta, Canada in 1925 and continued to 1930. The work was conducted with alfalfa at Lethbridge (dry land and irrigated) and at Brooks (irrigated). When the seeding was done on the 8th and 26th of May under irrigation, most of the germination had taken place by the end of June. In 1926, alfalfa samples which had been treated in different ways were tested in plots at Lacombe and Brooks. From these two years' results with alfalfa it was concluded that hard seeds had practically the same value from the point of view of the number of plants produced as had the permeable seeds. Heavy scarification was shown to be detri-

mental to field germination. Permeable seeds gave more prompt germination, but the hard seeds caught up by the middle of the summer. The work in 1927 was devoted to sweet clover. By means of a mathematical formula which he developed, it was shown that the value of hard seeds of alfalfa ranged from 70 to 85% at the end of the first season, and that hard seeds of sweet clover averaged about 50% of the value of the permeable seeds.

An interesting contribution to the explanation of why seeds are hard was made in 1932 by Hamly (9). In this work it was shown that permeability of naturally permeable seeds occurs through the opening of a cleft at the strophiole, and that this cleft can be produced in hard seeds by moderate heating or by mechanical impacting or throwing against a hard surface. Porter (31) and Hutton and Porter (14) found this impacting to be beneficial to black locust and certain other leguminous seeds. These findings substantiate the theories of Coe and Martin (2) and Lute (24) that impermeability is due to a condition of the cells, and to refute the earlier views of Nobbe (28) and the later beliefs of Nelson (27) and Schmidt (35) that this was due to a waxy coating over the seeds.

Interpretation by Association of Official Seed Analysts

A significant interpretation, which was made in 1921, relative to hard seeds, was embodied in the following resolution passed by the Association of Official Seed Analysts (1) at the Toronto meeting: "That it is the sense of this Association that the phrase, 'Percentage of Germination', as contained in various State Seed Laws, may be interpreted, by the officials concerned with the enforcement of these laws, as meaning the actual percentage which these seeds germinated, plus the percentage of hard seeds, but that the percentage of hard seeds must be stated separately on the label by the seed vendors".

It is apparent that this action on the part of the seed analysts had a stabilizing influence on trade practices and also served as a basis for regulations made by many of the states.

Interpretation Required by State Laws

The manner in which state laws and regulations require that seeds which contain hard seeds shall be labeled, is of considerable significance when it comes to a consideration of a policy for the evaluation of hard seeds. A survey made by Whitcomb (45) in 1937, of the 46 states which have seed laws, shows that 31 states have specific requirements in this matter. Twenty-four states specify that hard seeds shall not be added to the germination in the main statement, and of these 14 provide that such hard seeds shall be stated separately. Seven states require that hard seeds shall be included as a part of the germination, and five of these also require that the hard seeds shall be stated separately.

Work of the International Seed Testing Association

An active interest in the evaluation of hard seeds has been maintained by the International Seed Testing Association. In 1931, Witte (46) of Sweden presented a paper entitled, "Is it possible to formulate some universal rules for an estimate of the practical value of hard leguminous seeds?" He remarked that those hard seeds which germinate within two months are of the same value as the permeable ones sown at the same time, but no value can be accorded those that germinate later on since they are unable to survive the winter. He concluded by

saying that it is very difficult, at least for the time being, to state any universal rules for an estimate of the value of hard seeds for one does not know for what purpose a commercial seed is going to be used.

At this same meeting, some experimental data were given by Witte (47) and it was decided when interpreting the "germinating capacity" to add 1/2 the hard seeds to the germination for red clover and alfalfa and 1/3 of the hard seeds of the other legumes.

At the congress in 1934, some international investigations concerning hard seeds were reported by Witte (48) and it was decided to conduct further investigations.

At the Congress in 1937, further international investigations regarding the germination of hard seeds were presented by Witte (49) and definite recommendations were made relative to the evaluating of hard seeds. These were incorporated in the International Rules for Seed Testing (15) and made to read as follows:

"In calculating the percentage of pure viable seeds or the germinating capacity, there should be added to the germination figures the total percentage of 'hard seeds' found in Medicago sativa, one-half of the percentage of 'hard seeds' present in all other leguminous species".

It should be noted in the above provision that it applies to the calculation of "pure viable seeds" and not to the original statement as to germination. To make this clear, the International Analysis Certificate provides space as follows:

Germinating capacity (normal sprouts)	%
Hard seeds	%
Pure germinating seed (germination plus certain % of hard seeds)	%

Discussion of Methods of Interpretation

This review of the suggestions made during the past 27 years, relative to the evaluation of hard seeds, shows that there has been a close agreement as to the relative value in alfalfa and the clovers. There has also been a fairly uniform recognition of the fact that the hard seeds which do not germinate the first year will usually come on the next or succeeding years if conditions are favorable. If the land is kept in the same crop, these hard seeds which germinate the second or following years will thicken up the stand and be a real benefit, but if the crop is changed, these same seeds may produce undesirable results.

It is apparent from the above that careful consideration must be given to the formulation of a policy for the evaluation of hard seeds. It should not only help the user in deciding how much seed to plant per acre but should also inform him as to the possibility of some of the seed not germinating until the second year and thus perhaps contaminate another crop and produce mixed seed or contribute to other undesirable conditions.

To meet these requirements it is evident that more is needed than to add a certain percentage of the hard seeds to the germination percentage. Some information as to the probable behavior of such seeds is very essential. Since it has been shown that the hard seeds of different species respond somewhat differently under varying conditions, it seems desirable to provide some such information with the reports on tests.

A Suggested Policy

Based on the experimental evidence which has been submitted and giving due consideration to the various statements which have been made relative to the interpretation of the value of hard seeds, the following policy is suggested:

1. State the percentage of germination and the hard seed separately for all seeds.
2. State the germinating capacity as the percentage of germination plus the following amounts of hard seed for the respective kinds of seeds:
   (1) Alfalfa, peas, beans, smooth vetch, crimson clover, and Korean lespedeza . . . . . All the hard seeds
   (2) Red Clover . . . . . Half the hard seeds
   (3) Other leguminous seeds . . . . . .One-third the hard seeds
3. Attach to the report a concise statement relative to the behavior of the hard seeds of the various species under varying conditions.

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APPLICATION OF TOLERANCES TO SEED ANALYSIS AND LAW ENFORCEMENT [1]

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Errors in the results of seed analysis (including both purity and germination) have been ascribed to various sources. Probably the most satisfactory classification is their division into random sampling error and experimental error, the latter being further divided into systematic errors, or those which operate in only one direction, and random errors which may operate in both directions. Random sampling errors, of course, as the name implies, may be in either direction. It is these which are usually considered in the statistical treatment of seed analysis data. Allowance may have to be made, however, in certain cases for experimental error.

In considering tolerance we really have three problems which perhaps have not always been clearly enough distinguished in the minds of seed analysts and which I propose to discuss separately.

There is first the problem of comparing two or more results obtained on the same sample by a single laboratory or even a single analyst. Extensive experiments conducted by Porter (8)[2] Przyborowski and Wilenski (9) Woodbridge (11)

1. Contribution #597, Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.
2. Numbers in parenthesis refer to Literature Cited.

Yakushevskaya (12) Leggatt (2.3,I,VIII.) and doubtless others have shown, variously for purity and for germination, that in many cases no greater variations need be encountered in the work of any one laboratory than those due to random sampling error. In other words, experimental error can be controlled to the point where it should not enter as a factor into the variations observed. Thus tolerance latitudes in this case may be defined as limits wide enough to admit variations of a magnitude which might reasonably arise on account of sampling error while excluding those which might not. Since this is the case, such a tolerance should be calculated from the known statistical relations of the working sample in question. Here I would like to protest once again against the tolerance for percentage purity embodied in our Rules, especially its use for the present purpose. It bears not the slightest relation to the variations which actually occur and except in a very restricted range its use gives altogether too optimistic a picture as to the compatibility of two tests. This, no doubt, is flattering to our professional self-esteem but is dangerous in lulling us into a false sense of security

In comparing two tests we ask ourselves, in effect, "What are the chances that these two tests could result from the analysis of two replicates from the same properly mixed sample?" Statisticians, on the basis of wide experience of a multiplicity of problems have, rather generally, used the 5% and 1% points (i.e. $P=.05$ and $P=.01$) as descriptive limits in discussing the significance of differences. They may be interpreted somewhat as follows: -

> If the statistical calculation shows that the observed difference would be likely to occur less often than 5% of the time if a great many similar trials could be made of the same, properly mixed material, the chances are poor that the samples represent equally well the bulk from which they are drawn or that they represent the same lot. The same remark with respect to the 1% point would state that it is very highly improbable that they could represent the same lot equally well and so on.

There is no reason to suppose that confidence coefficients which have been found acceptable in the general body of statistical practice should not be so in seed analysis, except possibly in so far as they relate to the practical issues of law enforcement, which however we are not for the moment discussing, and for the present purpose I believe that these limits should be adopted.

Our problem, then, is simply one of determining the chance that as great a difference as that observed might occur. Various methods for doing this exist as for instance, in certain cases referring to Table 2 of the A.O.S.A. Rules, the use of the standard deviation of a difference as suggested by Collins (1) or the chi-square test which the present author has used and on which the formulae proposed by him were based. When this examination has been made, if it is found that $P<.05$, a retest is probably desirable. It has been demonstrated, however, both by Mercer (6) and Stevens (10) that because two analyses are in close concordance is not necessarily any indication that their mean gives a more accurate picture or is more reliable than the mean of two divergent analyses. The retest suggested above is merely a precaution against the possibility that errors other than random sampling error are affecting the tests.

Sometimes it is desirable to test the divergence of a single replicate from several others. This may be done by the use of formulae (3, II, V.4) and tables* for germination latitudes (3,II) based on them which have been presented

* These tables are calculated for $P=.025$ since it was felt desirable to make allowance for possible errors in excess of random sampling error. That this happened to make the necessary allowance rather accurately when the work of different stations is being compared has been demonstrated elsewhere (3,VIII). No additional allowance of this kind should be made, however, for the work of a single station.

by myself. A word of caution, however, is needed. The formulae do not reflect the expected variability very accurately if the number of seeds used is too small or, except when a great many seeds are used as in the percentage purity test, when very high or very low percentages are in question. For very low numbers of weed seeds in a unit weight an appropriate correction is needed (5) a discussion of which at the time of writing is in press. The appropriate correction for percentage tests is being studied, but the error is on the "safe side" since the chi-square test does not indicate quite as great variability as actually may occur.

The two other problems are bound up with the question of law enforcement. There is first the comparison of two analyses made on two different submitted samples by the one laboratory, as for example in any one district in Canada where the tests on which the seed firms grade their seed and subsequent check tests are made by the one official laboratory and secondly when the two analyses are made by two different laboratories as when a label statement based on an analysis by a commercial laboratory is compared with an official analysis. In the latter case it has been shown for germination tests (3,VIII) that, under existing conditions, observed variability is somewhat greater than would ordinarily be expected owing to slight differences in the level of interpretation of different stations.

Apart from the fact, then, that different values of P are appropriate in the two cases (at least for germination) the same general principles in relation to law enforcement obtain and may be discussed together, but the distinction should, in my opinion, be kept in mind.

This question of seed analysis and law enforcement is probably the most unsatisfactory feature of our work. Too wide a tolerance unduly favours the seller at the expense of the buyer, too narrow a tolerance is unfair to the seller, while a half-way compromise is really satisfactory to nobody. Przyborowski and Wilenski (9) have demonstrated in a striking manner the conflict in viewpoints of buyer and seller and they conclude that the only way this conflict may be resolved is by increasing the size of the sample.

It is a problem that has been attacked in a number of different ways and it would take too long to review them all here. One of the best approaches, in my view, is that in which violations are of two grades, such as technical and flagrant. They might be made to correspond with the 5% and 1% points respectively. But in order to avoid the need for excessively wide latitudes at these points, it is necessary to increase the sample; this in turn is too costly when only a small lot such as a single sack is being considered. Przyborowski and Wilenski (who are discussing dodder tests only in the paper to which reference is being made) point this out and suggest estimating the dodder content in a large number of sacks. I would propose a modification of this but my suggestions are made with some diffidence since I am not entirely familiar with the enforcement of seed legislation in the United States.

In the first place I believe that except in the case of the notorious "hit and run" dealer in seeds, under no circumstances should disciplinary measures be proceeded with on the basis of a single sample. Such a sample which, we may say, is a flagrant violation should serve as a warning signal for more of the identical lot to be picked up by the inspectors.* When these samples, which

* I am not, of course, ignoring the fact that much can be learned from the general quality of the sample when some of the original sample on which the given analysis was based is available for comparison. Here, however, we are merely discussing the statistical aspect of the question.

should number not less than 10, depending on the size of the lot, have been analysed the results, as suggested by Przyborowski and Wilenski, may be used for two purposes:-

(1) To determine whether the seed has been adequately mixed.

(2) To determine whether the "given analysis" is compatible with the real value of the lot as revealed by the analyses of the several samples collected.

In order to determine whether the seed has been adequately mixed we need to compare the observed results on the basis of whichever distribution is applicable. If we have sufficient data, the best way to do this is to arrange them in the form of a distribution and compare it with the corresponding theoretical distribution, using the chi-square test. When this is not possible, we may examine the dispersion of the results about their mean using again the chi-square test in the form appropriate to the data in question. When this has been done, if the lot is shown to be homogeneous, we may compare the mean of the official tests with the "given analysis" statement for the second purpose. If it is not homogeneous, then whatever measures are considered desirable, either cautionary or disciplinary, may be taken.

The following examples illustrate the procedure outlined. The first is taken from an actual case.

The legal limit was 5 noxious weed seeds per ounce. The "given analysis" on which bags were shipped showed 2 per ounce, one half ounce having been analysed. Official samples in the district to which they were shipped showed as many as 10 and 12 per ounce. Most of the shipment was returned and 98 bags were sampled in the district of origin, each sample being analysed. The following table gives these results:-

TABLE 1. - OBSERVED AND EXPECTED DISTRIBUTIONS OF WEED SEED RATES PER HALF OUNCE.

No. noxious weed seeds per half ounce analysed	Number of Cases	
	Found	Expected
0	3	4.8
1	17	14.5
2	26	21.8
3	16	21.9
4	18	16.6
5	9	10.0
6	3	5.0
7	5	2.2
8	-	0.8
9	1	0.3
10	-	0.1
Total Cases	98	98.0
Mean rate per half ounce	3.02	
X^2	3.072	
P	.53	

Here we have an excellent fit between the observed and expected frequency distributions. Thus there is no need to question the fact that the seed was properly mixed, nor is there reason to suspect any individual sack.

Since the table shows numbers in a half ounce we must double these to get the rate per ounce. We then see that the chance of getting 10 or more per ounce is about 18%.

We must now examine whether the "given analysis" is compatible with these results. The real mean rate is 3.02 per half ounce or 6.04 per ounce, thus more than the legal maximum. The question is, could seed of this quality be reasonably expected to give as low a test as 2 per ounce or 1 in the half-ounce analysed?

This may be done by direct inspection of the expected distribution. We see that the chances of getting 1 or 0 are approximately 19%.

Thus the fault lay in the fact that the original analysis was not made on a sufficiently large sample and not with the seed firm who acted in entire good faith but suffered a considerable financial loss.

Of course, it is not often possible to analyse as many as 100 samples of a single shipment. We may, however, have as many as 10 at our disposal and may have some such results as are shown in Table 2.

TABLE 2. - EXAMINATION OF 10 ANALYSES OF SAMPLES FROM, SUPPOSEDLY, A SINGLE SEED LOT.

Found in ounces examined.	
3	Given analysis -- 2 per ounce
7	
4	Actual mean rate -- 6 per ounce
10	
7	X^2 (with Yates correction) 19.04
1	
3	P .027
14	
6	
5	

Here we have a rather low value of P and the lot lacks homogeneity somewhat. A result as great as 14 appears open to suspicion.

Elsewhere (3,V) I have given formulae which are applicable to problems of this sort. The present may be examined by the formula for what I have called Case 2, namely an analysis compared with a fixed standard, since the mean of 10 samples may be considered large enough to serve as the fixed standard.

The appropriate formulae are:-

$$y = x_1(N_2-1) + u$$

$$u = +\sqrt{3.841\ N_2 x_1}$$

In the present case $N_2 = 1$, thus

$$y = +\sqrt{3.841\ x_1}$$

x_1 being the standard or in the present case 6. Solving the equation we have

$$y = +4.8$$

adding 1 for correction for continuity as I have discussed elsewhere (5) gives

$$y = 5.8 \quad \text{and the limit}$$

$$= 11.8$$

Thus 14 is outside the tolerance and the sack or parcel giving this result should be further examined. The rest of the analyses, however, are easily within the tolerance.

The same result may be obtained by reference to Przyborowski and Wilenski's (9) Table 5.

In order to test whether, in the absence of the appropriate Poisson distribution as in the present case, the "given" result of 2 per ounce is compatible with a mean rate of 6 per ounce, reference may be made to their Table 3. If Pearson's tables (7) are available, Table LII is convenient.

This will show that the chance of getting as few as 2 per ounce analysed, when the real rate is 6 per ounce is P = .06. This is just within the 5% limit, thus we may hold that the lot was not misrepresented by the given analysis in spite of a single sample which gave as many as 14.

The same general type of procedure may be carried out in the treatment of germination results. It may be assumed that the "given test" has been based on, usually, at least 400 seeds. Tolerance tables have been published (3,II) giving

the appropriate tolerance for various numbers of seeds used in the tests being compared. If an apparent violation has occurred, then several samples should be obtained of the same lot and the test results analysed for homogeneity, exactly as above, using the form of chi-square appropriate to the binomial distribution. If they prove to be homogeneous, then the mean of all the tests may be compared with the given test by the use of the following formula which is here given for the first time.

Germination Tolerance for Case 2.

(i.e. where a test result is being compared with a fixed standard). Where y = the tolerance expressed as a direct difference in per cent from the stated germination standard.

N_2 = the number of seeds used in the test in question.

x_1 = the stated germination standard.

$a = \frac{N_2}{100}$

Then $y = \frac{u(-1)}{a}$ and $u = \sqrt{\frac{X_2 a x_1 (100-x_1)}{100}}$

The correction factor (-1) is placed in brackets to signify that 1 is subtracted from the absolute magnitude of u regardless of sign. The value of X^2 is assigned according to the confidence coefficient desired.

The formula for the present purpose is applied simply by considering the mean of the large number of tests as the fixed standard. In the present case we use the positive value of y, thus y is added to the fixed standard. (When N_2 = 100 the value of y should be taken to the nearest whole number; for values of N_2 = 200 or more use the actual value of y as the dividing line.) This gives the highest value which may be said to be compatible with the standard. The following example should make this clear: -

The statement on the label gives 90% germination. An official test on 400 seeds gives 84%. On the basis of two tests, each on 400 seeds the tolerance table shows this to be too low. Ten official samples of the lot are picked up and give the following results based on 400 seeds each:-

Percent	
83	
87	
87	
85	Mean 87.0%
88	
89	X^2 = 12.72
87	
90	P = .17
88	
86	

The X^2 tests shows these to be quite reasonably homogeneous. We may now compare the mean, 87%, based on 4000 seeds with the 90% given germination using the formula just presented.

Here N_2 = 400 (we assume this)

x_1 = 87

a = 4

X^2 is put equal to 5 since the work of two different stations is in question.

$$\therefore \quad u = \frac{5 \times 348 \times 13}{100} = \sqrt{226} = \pm 15.03$$

$$u(-1) \quad 14.03$$

$$y \qquad \frac{u(-1)}{a} = 3.51$$

Thus the upper limit would be $87 + 3.51 = 90.51$.

The given test, therefore, falls within the tolerance and accordingly there is no reason to suppose that it misrepresents the seed.

A similar procedure and the same formula may be used for percentage purity.

During the preparation of this paper we have had occasion to calculate binomial distributions for various values of P and n. These appear to be so useful that we are preparing tables of cell frequencies for the binomial probability summation similar to Pearson's Table LII for Poisson's exponential series. These will, we hope, be published from time to time through the pages of the News Letter.

In the foregoing I have suggested certain procedures which might be followed in handling tolerances both for seed analysis and law enforcement. Tolerances must really, however, be considered only as a guide. They cannot replace a first-hand knowledge of the seed firms with whom one is dealing and of their intentions of cooperating with enforcement officials or not. In general I think it unwise to institute action on account of an individual shipment even if it is a bad violation (except in the case of a firm which has already given evidence of carelessness or bad faith) but rather that a seed firm should be judged on the basis of the general run of official tests on its samples during the season.

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TESTING OF NATIVE GRASS SEEDS AT THE KANSAS STATE SEED LABORATORY

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The Kansas State Seed Laboratory received 98 samples of native grass seeds during the last fiscal year. A large percentage of the samples were mixtures of native grasses with the two bluestems Andropogon furcatus and Andropogon scoparius predominating. Included among the samples were switchgrass (Panicum virgatum), Indian grass (Sorghastrum nutans), long leaved rushgrass (Sporobolus asper), and Western wheat grass (Agropyron smithii).

Since there are not definite rules for testing native grass seeds, it has been necessary for laboratories to work out their own methods of testing. This particular problem may not be of equal interest to all laboratories. Seedsmen in the Middle West are already buying and selling native grass seeds. A high percentage of the samples received at the Kansas Laboratory were from seed dealers. It is hoped that through suggestions and experiences of laboratories that a helpful procedure for the testing of certain native grass seeds can be outlined.

The majority of the samples contain a large proportion of trash, straw, and weed seed. The light fluffy seeds of certain species and the hairy glumes and sterile florets of others, present problems in making purity analyses.

The first procedure which was followed at the Kansas Laboratory was the making of caryopses counts on the Andropogon spp., since they were considered to be the most valuable species. One hundred bluestem florets selected at random were examined for caryopses. Twenty-three samples examined in this manner gave an average of 27%. Additional information, which included the approximate amount of other species present, as well as the amount of inert was included in the report.

A second method differed from the first in that the usual purity analysis was made on a five gram working sample. There was one exception which is as follows: All bluestem florets were placed together regardless of the presence or absence of caryopses. The usual caryopses count was made. Eight samples examined in this manner averaged 36% Andropogon spp.. The samples averaged

40 caryopses per one hundred florets. Inert matter averaged 31%. The percentages of other valuable native grasses and weedy species were also reported. This method shows some improvement over the first, however, it still does not give the actual percent of pure Andropogon seeds present.

A third method of purity analysis and the one in use at the present time is essentially as follows: Using a five gram working sample the procedure is similar to that of ordinary purity tests. All inert matter as well as all other seed is separated and classified, leaving only the pure seed of the bluestems. The one difficulty with the bluestems is in determining sterile florets or empty florets from those containing caryopses. It is necessary to hold the floret with the tweezers in the right hand and run the fingernail of the first finger of the left hand over each floret to determine the presence of caryopses. This is a slow and tedious process but at present it is the only safe way known. It requires from four to five hours to make a single purity analysis. This procedure is similar to the one followed by the analysts of the "Soil Conservation Nurseries".

In Table I have been listed the purity results of 27 samples of mixed native grasses. The percentages of purity of Andropogon spp., Sporobolus asper, Panicum virgatum, and Sorghastrum nutans, have been stated. All of the samples contained Andropogon furcatus and Andropogon scoparius. The 27 samples averaged 21.34%. No attempt was made to determine the proportions of each, although they can readily be distinguished if enclosed in their glumes. The majority of samples contained naked caryopses and these are not easy to classify.

Sporobolus asper was found in 23 samples with an average of 15.84%. Panicum virgatum was present in 24 samples and averaged 1.27%. Sorghastrum nutans was a constituent of 15 samples with an average of 2.21%. Other valuable species of native grasses included were side oat grama (Bouteloua curtipendula), northern dropseed (Sporobolus heterolepis), and species of wild rye (Elymus spp.)

The 27 samples of mixed native grasses average 54.82% inert matter and 2% of seed other than those mentioned above. Several of the samples contained as many as 12 kinds of other seed.

Weedy grasses which were present were wire grasses (Aristida spp.) Cheat (Bromus spp.), Windmill grass (Chloris verticillata), large crabgrass (Digitaria sanguinalis), barnyard grass (Echinochloa crusgalli), love grasses (Eragrostis spp.), wild barley (Hordeum spp.), panic grasses (Panicum spp.), Texas crabgrass (Schedonnardus paniculata), slough grass (Spartina sp.), dropseeds (Sporobolus spp.), and purple top (Trioda flava).

Weedy species included a number which are common to both overgrazed pastures and cultivated fields. The following genera were represented: Ambrosia, Aster, Achillea, Amaranthus, Amphiaxyris, Chenopodium, Carex, Grindelia, Helianthus, Iva, Leptilon, Linum, Rumex, Salvia, Solanum, Symphoricarpos, Verbena, and Vernonia.

The percentages of germination of bluestems have been given in Table I. The average germination for 22 samples was 40%. One sample of long-leaved rush grass (Sporobolus asper) germinated 62%.

The following germination procedure was followed at the Kansas Laboratory. Three layers of filter paper moistened with tap water or potassium nitrate are placed in Petri dishes. Duplicate tests, 2 x 100 seed with tap water and 2 x 100 with potassium nitrate are made. Samples are exposed to light from 6 to 8 hours a day at a temperature of 30°C and then moved to a dark germinator and kept at 20°C for 18 to 16 hours. Bluestems apparently pass through a dormant or resting

TABLE 1. - PURITY AND GERMINATION RESULTS ON MIXED NATIVE GRASSES

Laboratory number	Andropogon spp.	Sporobolus asper	Panicum virgatum	Sorghastrum nutans	Other seed	Inert matter	Germination
	%	%	%	%	%	%	%
3182	10.09	12.38	2.85	2.30	3.79	68.59	43
3183	15.22	6.00	trace	3.53	.65	74.60	42
3197	8.90	10.51	2.11	2.60	6.55	69.33	51
3990	26.74	38.45	16.89	1.60	.75	15.57	18
3991	26.03	49.41	8.24	.59	1.34	14.39	26
4158	18.32	1.52	3.15	1.78	3.37	71.86	34
4403	21.55	2.70	.77	-	.44	74.54	52
4448	26.42	2.72	.90	-	-	69.96	50
4485	17.23	49.08	1.95	trace	2.36	29.38	43
4805	6.11	2.98	2.91	-	24.31	64.39	34
5075	22.95	2.00	11.76	4.36	.87	58.06	24
5729	59.98	-	3.23	-	2.11	34.68	25
6748	10.63	21.40	1.10	1.10	.59	65.18	14
6774	47.36	-	2.81	1.00	.50	48.32	42
6982	13.64	22.17	4.36	.23	1.39	58.21	51
7076	12.93	21.08	18.54	1.04	4.02	42.39	58
7122	35.34	7.00	1.97	2.00	.16	53.53	0
7559	28.09	-	1.00		2.26	68.65	48
8193	29.93	-	-	-	-	70.07	47
8548	14.83	48.48	1.01	-	2.26	33.42	17
9237	8.24	8.16	2.42	.59	4.31	76.28	-
9540	5.75	65.80	1.46	-	6.00	22.99	-
9542	18.34	23.14	4.62	-	.92	52.98	42
9878	20.39	10.50	5.21	.90	.13	62.87	45
9918	31.16	4.00	2.23	8.82	3.58	50.21	13
11136	30.44	9.00	-	1.32	.15	59.09	-
11218	11.29	14.83	1.03	-	1.35	71.50	-
AVERAGE	21.34	18.84	4.27	2.06	2.97	54.85	40

period which continues until January or February. This can be broken by prechilling at 10°C or slightly lower for 7 to 9 days. Germination tests on bluestems require about 35 days. The period of prechilling is included in the period of germination.

The extensive use of many of the native grasses for revegetation operations had made it necessary for seed laboratories to perfect methods for analyzing these seeds. We would not suggest the establishing of definite rules of procedure at this time but we are of the opinion that interested laboratories should cooperate and eventually a satisfactory method may be perfected.

IDENTIFYING THE FESTUCA SPECIES IN COMMERCE (ABSTRACT)

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During the past season there have been a regrettable number of stocks of fescue seed on the market which were found to be blends, mixtures or misrepresentations as to variety. There seems to be an unfounded impression prevalent that these fescue seed stocks when once mixed cannot be again distinguished one from the other. Utilizing the information and methods presented by various investigators coupled with close observation of the gross characteristics it is possible to arrive at a very safe decision as to the general varietal composition of a seed stock in question. Any seed stocks which are found by laboratory observation supplemented by field or growth characteristics to be atypical should be examined critically by someone or all of the methods suggested and if valuable or useful varieties are found to be contaminated with the less desirable species they should be classed as "Mixed" and their varietal identity should be challenged.

This brief abstract deals largely with the identification of stocks of Festuca rubra L. (Red fescue) and its various forms, and with Festuca ovina L. (Sheep fescue) since they are the ones which are most often substituted in the trade because of a wide price differential.

Festuca ovina, (Sheep fescue) seed stocks frequently contain Aira caryophyllea and A. flexuosa, as type impurities and F. ovina var. duriuscula contains Aira caryophyllea, Bromus mollis, Ornithopus sativus, and Rumex acetosella. Both of these varieties can be detected in a mixture by these type impurities and by the fact that nearly always there is present from 6 to 11 per cent by count of the profusely hairy seeds of F. ovina. We have never found these profusely hairy seeds in either the genuine domestic or New Zealand grown stocks of Chewings fescue. When grown to seedling or plant size in soil boxes or in the greenhouse in order to note the cross section of the leaves as suggested by Thomas and Davies it is found that F. ovina is very variable but all forms can be distinguished from F. rubra by the sheaths of the radicle leaves which are split about half way to the base. The color of the seed of Sheep fescue in gross appearance is usually gray brown.

Festuca rubra (Red fescue) has several forms but F. rubra var. commutata Gaud. (F. fallax Thuill.), Chewings fescue, is the one most desirable for turf purposes and therefore adulterated with the more undesirable and less expensive stocks. Chewings fescue from New Zealand usually has Festuca myuros and F. dertonensis, Holcus lanatus, Hypochaeris radicata, and Trifolium spp., often T. dubium, as its most frequent type impurities. We have never found

Ornithopus sativus (Serradella) in genuine Chewings fescue from New Zealand or from Oregon. It is nearly always present in the European red fescue and Sheep fescue seed. The color of the Chewings and Red fescue seed is usually red brown and in some cases with a definite tinge of purple.

The general shape and sizes of the seeds of the various varieties are frequently very definite and useful for identification. The seed of genuine Chewings fescue are smooth and shiny and the few hairs present are more like tubercles. The sides or edges of the seeds are rolled in, resembling a canoe, as compared with the barge-like shape of the other varieties. The seed of the Olds strain of creeping red fescue from Canada is larger, rougher, but the roughness is due to fine hairs almost like fuzz. Also, some stocks of the Olds strain are occasionally weather stained yellowish, almost light canary yellow.

The length of the "seeds" (glume containing caryopsis) of a number of genuine stocks was found to be about as follows:

Festuca ovina, Sheep fescue,	approximately	4 mm in length
F. ovina var. duriuscula, Hard fescue,	approximately	4.5mm in length
F. rubra var. commutata, Chewings fescue,	"	5.0mm "
F. rubra, European red fescue,	"	5.75 mm "
F. rubra, Olds strain from Canada,	"	6.00 mm "

Of the fairly rapid methods of microscopic identification perhaps the two most useful are those of Leendertz, who showed that the base of the teeth at the edge of the palet is round on Sheep fescue and diamond shaped on Red fescue; and of Merl, who showed that the teeth on the veins of the palet of Red fescue have a broader base and a wider lumen than those of the Sheep fescue group. There are of course some exceptions and one must become well acquainted with the technique and these variations.

In ultra violet light the coleoptiles of Festuca ovina are faintly bluish while those of F. rubra fluoresce light green. The radicles of F. ovina are shining soft light-green while those of F. rubra are quite colorless. One needs to make several trials with genuine stocks in order to become familiar with these rather minute differences.

The chromosome number can be relied upon as a last resort in difficult cases. Festuca ovina has 14 chromosomes, except that F. ovina duriuscula (often in the trade as hard fescue) has 42 chromosomes. Festuca rubra varieties haye 56 chromosomes.

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THE INEFFECTIVENESS OF CERTAIN SEED TREATMENTS TO REVEAL ORIGIN OF RED CLOVER SEED [1]

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It is now generally known that there is a marked difference in the suitability for specific regions of stocks of red clover seed depending upon where they were grown. This is reflected in winterhardiness and adaptability. Price differential and the operation of supply and demand often bring about keen competition in the trade. Because of the fact that upon the open markets in this state red clover seed stocks were found which were misbranded as to origin, and even one lot was found which apparently had the tell-tale green-stained seeds removed, it seemed desirable to investigate the possibilities of using some more or less quick test or diagnostic method to distinguish the imported strains from the domestic ones without having to wait several weeks for the appearance of the hairyness on the stems of the domestic strains or on the other hand the lack of hairs on the imported European strains.

Gentner, in 1925, working in conjunction with many seed laboratories, carefully listed the type weed and crop seed impurities of red clover and other forage crops which could be used in determining the origin of the seed. He also investigated the use of seed color and weight per 1000 seeds as aids in tracing origin. The mineral content of the samples is very characteristic, and when carefully studied is a great help in determining the country of origin. The brilliancy due to the sodium content of the black earth of Hungary helps distinguish this seed from Russian seed. Weed and inert impurities, however, are not infallible evidence.

His work showed that the different countries vary in the proportions and dominance of the various colors in the red clover seeds. For example, the Swedish seed had 19% violet and 43% yellow; the Danish seed 1.2% violet, and 19.1% yellow.

He found that the seeds of two weeds, Heliocharis palustris and H. ovata are often found in American clover seeds. In Europe these plants occur only in marshes and very damp meadows, on the border of pools or in empty reservoirs but never in clover fields.

L. Francois, in 1925, investigated the question of the origin of seeds by their impurities using mainly weed impurities and inert matter. He found that the minute shells of Hellix variabilis are found in the lucernes and clovers of southern European origin. He used Trifolium supinum as a measure and, when, after careful field work he found that this annual was not found in French fields but was abundant in Italian fields, concluded that the presence of this seed was a sure indication that the seed was not of French production.

Since there is such a high premium on domestic seed and blending of seeds of widely separated origins is prohibited, and since the extensive speculation in and transfer of and importation of seeds and packing materials has successfully caused a cosmopolitan scattering of weed seeds, some method of determining origin other than impurities, a method using the inherent characteristics of the

1. Approved by the Director of the New York State Agricultural Experiment Station as Journal Paper No. 339.

seeds, would be highly useful in origin determination.

At this Station the control field plots of red clover showed that the stems of the Canadian and United States produced red clovers were hairy. Those of imported European red clover were relatively smooth, losing their appressed pubescence at an early stage. If this character could be forced precociously on the seedlings on germination blotter the growing test, so to speak, for origin could be finished within a few days in the laboratory.

Methods and Results

Occasionally an abnormal clover sprout will show the first internode and primary foliage leaves. The stem in such a case emerges from the split base of the hypocotyl. These first internodal stems show the hairy character. The aim of this experiment was to force this obnormality in sufficient quantity to use it as a diagnostic character. The European types would presumably have smooth stems and the North American type hairy stems.

Clover seedlings when allowed to remain in the germinator long enough to produce normally the first internodal growth required too long a period and frequently were killed off by fungi.

In the test herewith reported duplicate sets of seeds, that is, those unstained as well as those seeds which were stained green and purple were used in order to be certain that the origin was as stated. The germination of the stained seeds showed no abnormalities, indicating that the stain itself did not affect the seed.

The sprouts of untreated seeds of both imported stocks were carefully dissected after 5 days of germination. The cotyledons were pulled apart and the plumules was removed with a razor blade. This tiny plumules was then placed on a microscope slide in a drop of dilute fast green or biebrich scarlet stain and covered with a cover glass and examined under a compound microscope. Both the European and the American clovers had hairs on the primary leaves and on the stem. No difference in the structure or arrangement of these hairs was discernible.

Neither a variation of the temperature factor in the germinators using 18°C, and 20°, and 30° nor a variation in the light factor using both daylight and darkness produced abnormal sprouts showing the desired precocious stem development in red clover.

The seeds were treated with liquid indolebutyric acid in concentrations ranging from one part per million to one part per hundred of water. In the higher concentrations the hormone produced abnormal sprouts. The stems were thickened and distorted but the first internode was not forced and in this respect seeds of both origins reacted the same.

New Improved Ceresan used in the proportion of one part Ceresan to five parts French talc caused a typical mercuric injury and there was no difference in the average proportions of injured to uninjured seeds of both series.

Seed were soaked in one part commercial formaldehyde to 320 parts of distilled water for 10,20,30,40,50, and 60 minutes in covered petri dishes. Then each set was decanted and allowed to stand in the fumes in the covered petri dish for one half and one hour periods. Those seeds exposed for the longest period showed slight root injury, but the stems of both European and American grown clovers were normal so far as could be determined by means of the binocular microscope and by means of free hand sections viewed under the compound microscope.

A set of seeds was put in boiling water for one minute. Twelve European and eight American seeds were vigorous enough to withstand this harsh treatment. None of these 20 sprouts produced abnormalities in the 21 days they were kept in the germinator.

When seeds were treated with mercury bichlorid, aluminum potassium sulphate, and potassium chromate, the stunting occurred in both series. The origin of the seed bore no relation or selective tolerance to the chemicals.

When the dry seeds were crushed, treated with chloral hydrate and viewed under a microscope there was no preceptible color reaction in either the European or American clovers.

When seeds were treated on blotters with taka diastase, in 2 cc to 5 cc of distilled water, there was a common stunting of root and root hair growth for both series.

The application of high concentrations of potassium nitrate caused no abnormalities in either series.

The power of x-ray to produce variants from the normal form is well known, therefore it was used in this investigation. The x-ray part of this experiment was fairly extensive. The clovers of both origins were given identical x-ray treatments. In all cases the P. ku was 30, the ma 10, the distance 5 inches and there were six time groups of 5,10,15,20,25 and 30 seconds respectively. The seeds were then placed to germinate on blotters at 20°C. The plumules and entire sprout were carefully observed under the binocular microscope for abnormalities and any differences. At three different intervals when full percentage of germination was reached, groups of ten sprouts from each series and from each of the six time groups were measured as to root and stem lengths and, the plumules dissected out and stained. The averages were compared. The results were consistently similar for the clovers of Europe and America. The stems and primary leaves in the early plumule stage were hairy on both series.

Summary

The occasional appearance of abnormal sprouts in which the stem splits and produces the first internode prematurely and which was felt to be of possible value in this investigation, may be an inherent character in that seed and would be inimitable by mere change of environmental conditions. Or, if the abnormality is due to some chemical breakdown in the constitutents of the seeds, the compound has not yet been found nor the necessary environmental factors causing the breakdown provided.

The variation of the heat and light factors, the application of indolebutyric acid, potassium nitrate, taka diastase, choral hydrate, ceresan, aluminum potassium sulphate, and potassium chromate, and the staining of the plumule with fast green and biebrich scarlet, and the treatment of seeds with x-rays proved of no value in that they showed no difference in the tolerance, nor in reaction, nor did they hasten the development of the hairy character to differentiate the red clovers of European and North American origins when the tests were carried as far as is practical in seed laboratory germination procedure.

THE PUBESCENT CHARACTERISTIC OF RED CLOVER, TRIFOLIUM PRATENSE, AS RELATED TO THE DETERMINATION OF ORIGIN OF THE SEED (ABSTRACT)[1]

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In greenhouse plantings, 200 seed of each lot of imported Canadian and European red clover, Trifolium pratense, seed and domestic red clover seed, were planted in small flats with the seed spaced 3/4 by 1 1/2 inches apart during the fall and winter of 1938-39. When the seedling plants were from 4 to 6 inches in height they were dug and classified as to position of the pubescence on the leaf petioles. Results indicated that seedling plants of European forms of red clover having appressed pubescence can be distinguished from the rough pubescent American forms thus providing a suitable method for rapid analysis to determine the proportion of each form in a sample of red clover seed.

The identification of European forms in imported lots of Canadian red clover seed of itself would not necessarily mean that European red clover seed had been mixed or blended with Canadian seed before importation.

Purity analyses in the Enforcement of the Federal Seed Act of 122 lots of imported Canadian red clover seed at time of entry into the United States resulted in 11 lots that were considered questionable as to source of origin because of the presence of European weed seed. In the seedling plant study these 11 importations comprised all but two of the lots having 20 percent or more of European appressed pubescent plants.

The presence of characteristic European weed seed in imported Canadian red clover seed lots containing a high percentage of European forms of red clover plants does appear to indicate that in some cases European red clover seed has been blended with or substituted for Canadian grown seed.

This conclusion seems justified since characteristic European weed seeds found in European red clover seed are not found in samples of red clover seed grown in the United Stated and Canada.

NOTES ON THE VIABILITY OF THE IMPERMEABLE SEED OF VICIA VILLOSA, HAIRY VETCH

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The question of the value of the impermeable seed of legumes has long been of interest and much has been published on various phases of this problem. No attempt will be made to review this vast amount of leterature. The data presented here concern the viability of the hard seeds encountered in testing seed of hairy vetch, Vicia villosa.

Fourteen import samples of hairy vetch which had been stored in the laboratory in closed tin cans since receipt are included in this study. The germination tests were conducted between moistened paper toweling at 20°C. A total of 400 seeds per sample was used in the original germination test; 1,000 seeds per sample was used in the October, 1938 test from which the hard seeds were saved

1. For full text of this paper see Jour. Amer. Soc. Agron. 32: 1-11. 1940.

for scarification studies. The seeds were scarified with an electric needle as described by Shuck (4).[1]

The results of the original germination, the retest, and the germination of the treated seeds are given in the table. The percentage of hard seed had not decreased during the approximate two years of storage as was noted by Harrington. Two samples showed a marked increase of impermeable seed during storage. It is probable that the tops on the cans in which these 2 samples were stored were not tightly closed. Jones (3) has shown that the storage temperatures and humidities greatly influence the percentage of hard seeds in Vicia villosa, high humidity decreasing and low humidity increasing the proportion of hard seed.

Twelve of the 14 samples studied had a very high percentage of viable hard seed. Sample 33818-1 had 63% of dead among the scarified hard seed. This sample originally had a potential value of only 65%. When the retest was made it was noted that many of the seeds had a sweaty appearance, some of the seeds becoming permeable without any noticeable swelling. This was the only sample in this series that had this sweaty appearance and the only sample to have a high percentage of dead impermeable seeds. In routine testing of Vicia villosa, we had previously noted this characteristic in samples of low vigor.

Witte (5) has stated that in nearly all of his experiments hard seeds seldom are dead. The present results show that one may encounter samples of low viability in which a high percentage of the hard seeds are not viable. Goss (1) has shown that an appreciable percentage of hard seeds of hairy vetch may not be viable; he found the shrivelled hard seeds more apt to be dead.

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1. Numbers in parentheses refer to Literature Cited.

TABLE 1. - GERMINATION OF SEED OF VICIA VILLOSA

No. of sample	Date of germination	Germinated	Abnormal sprouts	Dead	Hard Seed	Germinated & hard seed	Scarified hard seed		
							Germinated	Abnormal	Dead
		%	%	%	%	%	%	%	%
33804 B	10-7-36	84			11	95			
	10-6-38	77	1	15	7	84	100		
33818-1	9-26-36	61			4	65			
	10-6-38	52	6	35	7	59	32	5	63
33855-1	10-1-36	92			6	98			
	10-6-38	89	2	4	5	94	98		2
33856-1	10-1-36	88			5	93			
	10-6-38	84	3	4	9	93	97		3
33875	10-6-36	92			4	96			
	10-6-38	92	2	3	3	95	97		3
34037	10-24-36	85			12	97			
	10-6-38	79	1	2	18	97	97		3
34334	11-19-36	82			14	96			
	10-6-38	77	3	5	15	92	99		1
34501	12-4-36	77			19	96			
	10-6-38	76	1	5	18	94	97	1	2
34517	12-6-36	79			18	97			
	10-6-38	75	2	5	18	93	97	1	2
35675-1	3-22-37	84			15	99			
	10-6-38	79	2	3	16	95	99		1
35706-2	3-25-37	81			16	97			
	10-6-38	80	1	5	14	94	100		
35912	4-26-37	51			47	98			
	10-6-38	55	1	4	40	95	98		2
36094	5-25-37	84			14	98			
	10-6-38	52	3	7	38	90	86	3	11
36156	6-17-37	82			17	99			
	10-6-38	49	2	9	40	89	92	4	4

NOTES ON FLOWER SEED GERMINATION

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The problems of flower seed germination are varied and interesting. They present many difficult and some unsolved problems. Most of our cultivated flowers are still much closer related to their wild predecessors than are our other cultivated crops so that they are still apt to be uneven in quality and subject to periods of dormancy.

Other factors which complicate the length of the dormant period and the viability of the seed are variations in harvesting conditions and variations in cleaning methods. In most cases where dormancy is a problem the seed will germinate after a short period of prechilling (4-7 days) at 5°-8°C. or at 13°C. In some cases light or potassium nitrate(.2% solution) is necessary to obtain germination of dormant seed. The value of hard seeds in a sample may be determined by treating the seed with concentrated sulphuric acid. The time of treatment varies with the species and in all cases the seed should be thoroughly washed immediately following the treatment.

On the whole it is our opinion that due to the variation in the inherent nature of most kinds of flower seed, it would be impractical to try to establish definite germination standards or standardized methods for testing germination A few kinds have been in cultivation for a long enough time that they are fairly constant in nature. It may be expected that more and more varieties may become uniform as they become firmly established in the trade; as are most of our vegetable forms.

It has been found in our laboratory that in general botanically related

groups of plants require similar germination conditions. This is not true in many cases, especially where different members of the same large family are widely distributed ecologically. In these cases the plants may fall in additional groups more closely related in their native habitat. The following notes show our findings in this relation. In a number of cases seeds grow equally well under other conditions than those mentioned but will perform most consistently at the given temperature.

In the methods given below cold temperature refers to 13°C, cool temperature to 20°, and warm temperature to alternating temperatures, 6 hours at 30° and 18 hours at 20°C.

GRAMINEAE --The grasses are mostly quick growing and respond to warm temperature (20°-30°C). Light is usually helpful. Short dormant periods are treated by prechilling. Example:-Job's Tears.

LILIACEAE --Lillies are very slow growing and grow best at cool (20°C) temperatures. Light is helpful. Examples: - Agapanthus, Dracaena, Freesia, Lilium, Smilax.
Exceptions: - Asparagus grows best at 20°-30°C.

AMARANTHACEAE --The amaranths grow quickly at high temperature (20°-30°C) and sometimes require light if dormant.
Examples: - Amaranthus, Celosia, Kochia.

CARYOPHYLLACEAE -- The pinks all grow quickly and respond to cool temperature (20°C). Short dormant periods are treated by prechilling or light at 20°. Examples: - Agrostemma, Arenaria, Carnation, Cerastium, Dianthus, Gypsophila, Lychnis, Saponaria, Silene.

RANUNCULACEAE --This group is slow growing and requires cold (13°C) temperature. Dormant seed requires about twice the normal growing period and often responds to alternation of temperature (13°-20°C). Examples: - Anemone, Delphinium, Geum, Larkspur, Thalictrum. Exceptions: - Aquilegia does best at 20°-30°C. with light.

PAPAVERACEAE --The poppies are dormant for several months after harvest and germinate best at 13°C.with potassium nitrate. Later they respond quickly to 20°-30° with light. Sometimes old seed does better at 13°C. Examples: - Argemone, Eschscholtzia, Hunnemannia, Papaver. Iceland poppies (P. nudicaule) require potassium nitrate.

CRUCIFERAE --The mustards grow fast at cool temperatures (20° C), many of them responding to light. There is often a short period of dormancy which requires prechilling or potassium nitrate. Examples: - Alyssum, Arabis, Aubrietia, Candytuft, Cheiranthus, Erysimum, Mathiola, Stocks, Wallflower.

LEGUMINOSAE --Many of the legumes have hard seed which do not respond during the usual germination period without special treatment. Some require cool temperatures (20°C) --i.e. Sweet Peas and other species of Lathyrus--and others respond to warmth (20°-30°)--i.e.--Baptisia, Dolichos, Lupins.

EUPHORBIACEAE--Warm temperature (20°-30°C) is best for the Euphorbias. Many species germinate easily and quickly but Euphorbia variegata has been difficult--a 90 day greenhouse test in which rainwater was used for watering proved the most satisfactory method.

MALVACEAE-- The Malvas, due to their large amount of hard seed, are low

germinating at all temperatures. The germination of permeable seeds is very quick (3-5 days) at all temperatures. Examples:- Abutilon, Hibiscus, Hollyhock, Lavatera.

VIOLACEAE -- The Violets grow best at 20°C with light. Examples: - Violet, Viola, Pansy.

ONAGRACEAE -- Species of this family often grow easily at higher temperatures but 13°C allows the most consistent germination. They grow quickly. Examples: - Anagallis, Clarkia, Godetia, Oenothera.

CONVOLVULACEAE -- Many species in this group are hard seeded. The permeable seeds grow quickly at warm (20°-30°C) temperatures. Examples: Convolvulus, Ipomaea.

POLEMONIACEAE-- Cool temperature (20°C) is best for most species. They grow quickly and easily. Examples: - Gilia, Phlox.

HYDROPHYLLACEAE—Cold (13°C) is best for maximum germination. Examples: - Nemophila, Phacelia.

BORAGINACEAE—Most species have very hard coats and are slow growing. Cool (20°C) or cold (13°) temperature is best. Examples: - Anchusa, Echium, Myosotis. Cynoglossum requires potassium nitrate.

VERBENACEAE-- The Verbenas are slow growing and the germination low in many instances. Warm temperature is most favorable.

LABIATAE -- The members of the mint family are on the whole slow growing and difficult to germinate. Most of them respond best to 20°-30°C with light. Examples: - Coleus, Nepeta, Salvia.

SOLANACEAE-- These on the whole respond best to warm (20°-30°C) temperature and light. Salpiglossis is often dormant for several months after harvest and responds to 13° and potassium nitrate. Examples: - Datura, Nicotiana, Petunia, Physalis, Salpiglossis, Solanum.

SCROPHULARIACEAE--Species of this family often have a dormant period which requires prechilling. Examples: - Antirrhinum, Digitalis, Linaria, Nemesia, Penstemon.

CAMPANULACEAE--Cool temperature and light are best for the germination of species in this family. Examples: - Campanula, Platycodon.

COMPOSITAE-- The Compositae are a large and varied group. Most all of them have a period of dormancy which is broken by prechilling and light. Most species respond quickly to warm temperature (20°-30°C). Examples:- Achillea, Acroclinium, Agathea, Ageratum, Anthemis, Bidens, Centaurea, Coreopsis, Cosmos, Crepis, Calliopsis, Dahlia, Gaillardia, Gerbera, Helianthus, Marigold, Matricaria, Rudbeckia, Venidium, Zinnia. Exceptions: - those favoring cool (20°) temperature: Asters, Bellis, Cineraria, Chrysanthemum .

those favoring cold temperature (13°): Calendula, Cosmidium, Dimorphotheca.

BOILING-WATER TREATMENT AN AID IN GERMINATING BUR CLOVER SEED

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Methods for germinating the seed of bur clover (Medicago arabica or M. maculata) in the bur have recently engaged the attention of seed analysts in some of the southern states. Even in those states where bur clover is grown the crop has not attained enough commercial importance to warrant an interest in laboratory methods for germinating the seed of this southern crop such as obtains with seeds of crops which are more commonly grown. For these reasons, it is presumed, laboratory methods for germinating the seed of bur clover in the hull have not been adopted by the Association of Official Seed Analysts.

Without previous treatment of some kind, the seeds of this species germinate very slowly and un-uniformly both in the field and in the laboratory. As a field practice the seed in the unhulled condition is sown broadcast between corn and cotton rows after the last cultivation of these crops. This early seeding is practiced mainly for the reason that the slow germinating process makes fall planting impractical. In other words, bur clover seed planted in the fall when other fall crop seeds are planted do not have time enough to germinate and establish a root system that will endure the winter months.

To overcome the disadvantage of planting the seed in the summer months, usually the months of least rainfall, McNair[1] developed a method of hastening the germination of bur clover in the hull by "scalding" the seed. Duggar and Tisdale[2] describe as a means of hastening the germination of bur clover "Soaking in water at room temperature for four hours and then keeping in boiling water for one minute."

The four-hour treatment in water at room temperature is for the purpose of washing the seed bulk, composed of seed burs, leaves, bits of stems, and dirt, thus freeing the mixture of inoculating bacteria before immersing in the boiling water. The one minute in boiling water softens the impermeable seed coat and makes immediate germination of the seed possible. The "boiled" seed, when cooled, is then placed back in the room temperature water where it is stirred and mixed again with the inoculating bacteria. The seed thus treated may be sown as late as the middle of September in the northern half of Arkansas and as late as the middle of October in the southern half of the state, under average conditions.

The question of immediate concern is the laboratory method of making germination tests of bur clover seed samples. A few farmers grow large crops of bur clover and produce seed in commercial quantities. They call on seed laboratories for analyses and tests in order to meet the labeling requirements of state seed laws. The ordinary methods of germinating field seed in the laboratory usually give only 5 to 10 percent germination, due to the hard seededness of this species. By immersing the seed to be tested in boiling water for one minute, however, a germination test of approximately 50 percent may be obtained, with percentages of "hard seed" varying from possibly 35 to 40 percent, depending upon those factors of seed production that apply to other field seeds. Seed analysts naturally ask, first, of what value to farmers is a report from a seed

1. A. D. McNair, Farm Management Extensionist, Arkansas Agricultural Extension Service, 1913.
2. J. F. Duggar, and H. B. Tisdale. "Bur Clover Seed: Means of Hastening Their Germination". Ala. Agr. Exp. Sta. Circular No. 29. 1914.

laboratory showing that a sample of bur clover seed germinated 6% with 90% "hard seeds", according to the "standard" method, and second, of what value is a report on the same seed of a germination test of 50%, with 45% "hard seeds", tested according to the boiling-water method? Does the 6% germinated seed reflect the true germinability of the seed or does the report of 50% more nearly approximate the germinability? Should this Association go on record as favoring the "standard" method or as recommending the boiling-water treatment? It may be that the Association should not now adopt as a rule either method, inasmuch as there may be a need for more information relative to the behavior of the seeds of the species in question. There is need, however, for a uniform method of conducting laboratory tests so that southern analysts in particular will not be working at cross purposes.

Mr. Naff, one of the three largest bur clover growers in the world, of Portland, Arkansas, has had many years of experience in seeding, growing, and harvesting bur clover seed. The following statements from him should command the attention of people interested in the crop or in the seed of bur clover. In a letter written by him July 26, 1939, Mr. Naff makes this statement:

> "My observations lead me to believe that within a few months after planting, at least fifty percent of bur clover burs will germinate one seed. In 1937 I planted a small strip at the rate of forty pounds per acre and got a good stand which was turned under green in the spring of 1938 and followed by cotton. That fall, a fair stand came up though the land had never been planted to bur clover before 1937, and no seed had matured on it in 1938 ..... I do not know whether one seed from a bur can germinate one year and then the others germinate in other years or not. I do know that the forty pounds per acre mentioned above were fifty-five per cent pure and obtained the results mentioned. Certainly, a rather large percentage of the burs had to germinate at least one seed in the first year (1937) to produce the stand I secured."

It seems to the writer, that the standard method of germinating bur clover seed is almost totally unrepresentative of the viability of a seed lot of this species. The boiling-water method, on the other hand, results in a laboratory germination that, at least, more nearly approximates the germination of untreated seed in the field. In other words, the standard method of germinating bur clover seed does not result in a test that reflects the true germinability of the seed, while the pre-treatment with boiling water results in a test that indicates approximately what the seed will do, untreated, under field conditions, if sown in the summer and early fall months. Furthermore, according to extension specialists in Arkansas and Louisiana, treated seed planted from the middle of October to the middle of November, will result in growing crops that can come only from relatively high field germinations. Whether the farmer is to plant treated or untreated seed, the laboratory test of treated seed appears to be an approximate indication of what the farmer may expect of the seed under average field conditions.

INFLUENCE OF CHEMICAL AND THERMAL TREATMENTS ON INFECTION OF CRUCIFEROUS SEEDLINGS BY ALTERNARIA SPP. AND RHIZOPUS NIGRICANS[1]

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The pod-spot of cabbage and other cruciferous species has been known for many years in seed-producing regions. Chupp (1)[2] stated that in an epiphytotic year an estimated loss of 25,000 pounds of seed is not uncommon for Long Island. According to a recent report by Neergaard (3) this disease may be severe in Denmark. He has found the casual organisms, Alternaria brassicae (Berk.) Sacc. and Alternaria circinans (Berk. and Curt.) Bolle on many seed samples of cabbage. Both fungi were listed as associates of radish seed. Doyer (2) described and illustrated these fungi on pages 36 and 45 and in Plate XXV, "Manual for the Determination of Seed-borne Diseases," of the International Seed Testing Association. Walker (4) on the other hand emphasized that Puget Sound seed-stocks are not subject to contamination by certain seed-borne pathogens. Alternaria spp. are not specificaly mentioned but very likely these fungi do not infect seed in this region.

Information from certain European growers indicates that Alternaria pod-spot is recognized as a serious threat to the production of marketable seed. One grower resorted to seed inspections, especially of cabbage and radish, as a means of eliminating diseased seedstocks. Another grower admitted severe infections in cabbage and brussels sprouts. New Ceresan seed treatment was used as a remedial measure in preference to moist thermal soaks.

The latter method of eliminating microorganisms from cruciferous seeds has been practiced extensively in the United States by growers and also by seed testing laboratories. Apparently the organisms causing black-leg and blackrot are amenable to this treatment. Walker (4) stated that the hot water treatment is necessary to rid the seed of Alternaria spp. and that mercuric chloride is not effective.

The standard hot water treatment of 122°F for 25 minutes has been considered unnecessarily long for the elimination of Alternaria spp. Moreover it is objectionable on the basis of the work involved, loss of seeds and increase in growth of Rhizopus nigricans Ehr. the common black mold.

During the past year certain chemical protectants and disinfectants regularly used in seed treating have been compared with hot water for the control of Alternaria spp. Several mercury compounds are now recommended as dips for the control of pod-spot in seed-growing regions of Europe. A number of mercurials similar to those used in Europe have been tested at Geneva.

A sample of Copenhagen cabbage, 1937 Danish crop, appeared to be normally strong and free from disease in January, 1938. In November of 1938, however, the packeter who had purchased this seedstock experienced difficulty in germinating the seed. Fungus infections were found in 14% of the cotyledons while 38% of the plumules were discolored.

In tests at Geneva during December 1938 the most noticeable injury to infected germinants was a dark brown to black discoloration and superficial necroses at the base of the stem. Often narrow lesions extended 3 to 5 mm from

1. Approved for publication by the Director of the New York State Agricultural Experiment Station as Journal Paper No. 366
2. Figures in parentheses refer to Literature Cited.

the base of the stem and rarely involved from 10 mm to the entire length of the hypocotyl. The seed coats whether remaining on the blotter or adhering to the cotyledons were partially to completely covered with the black mycelium and spores of the fungus.

The correlation between basal and cotyledonary lesions varied somewhat depending upon the humidity and water movement but mostly upon the location of the seed coats and the extent of the inoculum in the seed. When the infested seed coats persisted around the cotyledons they, as well as the epicotyl, were usually destroyed. When the seed coats did not persist the cotyledons were minutely and sparsely spotted to almost entirely covered by numerous brown lesions. That the mycelium occurs in, or gains entrance to, the dorsal side of the cotyledons is shown by the greater extent of the lesions on these than on the axial surfaces. Discolorations were often evident on the dorsal side of the cotyledons when no abnormalities were observed on the axial side.

Preliminary tests involving untreated, New Ceresan treated and hot water treated seeds demonstrated the efficiency of both control methods. A soak of 25 minutes in hot water (50°C) increased the percentage of normal germinants from 64 to 76 while only 3% of the sprouts were infected by Alternaria spp. or Rhizopus nigricans as compared to 63% for the untreated tests. New Ceresan (instant dip in an 0.2% suspension) increased the percentage of normal germinants from 64 to 80 while only 5% of the seedlings were infected.

A number of other materials were assembled and applied as dusts or dips to subsamples of this seedstock. The dosages were not controlled by weighing but were dependent upon the adherence of each chemical to the seed. The hot water treatments were accurately timed and the temperature of the water closely approximated 50°C. The results expressed as averages from 8 replicated tests of 100 seeds each are presented in Table 1. The germination period unless noted

TABLE 1. - GERMINATION OF SEEDS OF COPENHAGEN CABBAGE AT 20°C AND EFFICIENCY OF CERTAIN SEED TREATMENTS IN REDUCING INFECTIONS FROM ALTERNARIA SPP

Seed treatment	Normal sprouts [1]	Weak sprouts	Infections on seedcoats or cotyledons	Lesions at base of stems	Damped-off sprouts
	%	%	%	%	%
DUST APPLICATIONS					
Barbak C	57	5	11	3	21
Cyprous oxide	80	3	3	1	5
Mercuric chloride [2]	80	4	2	1	5
Mercurous chloride	79	3	2	2	3
New Ceresan [2]	83	5	3	1	3
Semesan	79	4	3	2	5
Zinc oxide	69	4	9	2	14
INSTANT DIPS, 0.2 PER CENT SOLUTIONS					
Mercuric chloride	79	5	6	2	1
New Ceresan	81	4	3	3	4
HOT WATER SOAKS, 50°C					
15 minutes	78	4	3	1	3
20 minutes	79	4	4	1	1
25 minutes	72	5	3	0	1
CONTROLS					
Series 1	43	7	15	4	30
Series 2	38	8	24	2	32

1. Normal sprouts at end of 10-day test; for approximate percentages of normal sprouts at end of 6 day test add numbers in first and last columns.
2. A mixture of 1 volume of manufactured product with 5 volumes of French talc.

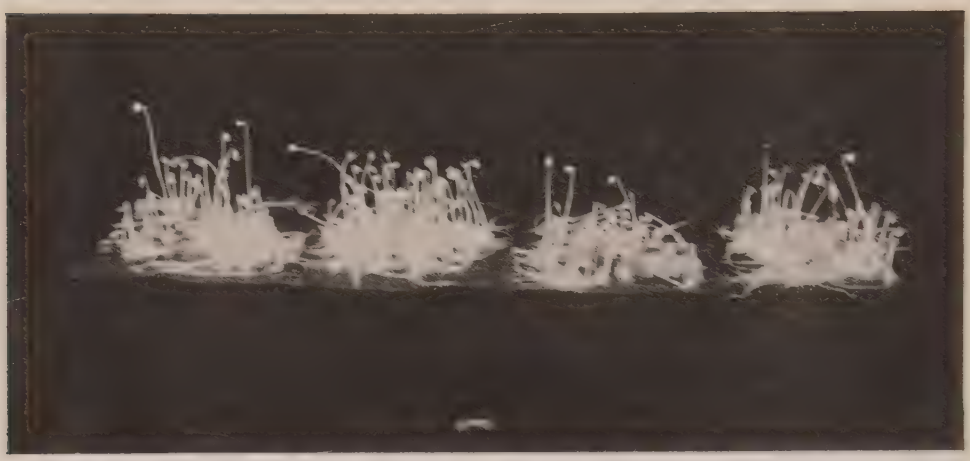

Figure 2 - Blotter tests of radish seed carrying a small amount of Alternaria infection. Left to right, untreated, Bertak C-treated, cuprous oxide-treated and hot water-treated tests of 100 seeds each.

Figure 1 - Blotter tests of Alternaria-infected cabbage seeds. Left to right: untreated, cuprous oxide-treated, hot water-treated and New Jersan-treated tests of 100 seeds each.

otherwise was 10 days. The percentage of infected sprouts was slightly less at the end of 8 days than for the 10-day period. The treatments, both chemical and thermal, reduced the percentage of Alternaria infected sprouts as illustrated in Figure 1. The mercurials compared favorably with hot water in this respect while the oxides of copper and zinc were noticeably less effective. The value of the treatments in preventing injury from Alternaria spp. became increasingly apparent as the germination period was lengthened.

Sprouts from uninfected seeds or kernels were almost completely destroyed in 12 days. Approximately one-half of the non-infected sprouts at the end of a 6-day test of copper oxide and zinc oxide treated seed were killed in 12 days. The percentage of infected seedlings increased only slightly during this period in the mercurial or hot water treated tests.

The beneficial action of the several seed treatments is dependent upon the percentage of Alternaria or Fusarium infected seeds. The results in Table 2 indicate the expected increases in normal sprouts when the fungus-seed associations are common. Experiments with clean or lightly-infected seed-stocks failed to demonstrate an increase in germination attributable to chemical or thermal treatments.

TABLE 2. - INFLUENCE OF CERTAIN TREATMENTS UPON THE GERMINATION OF SEED AND FUNGUS-INFECTION IN RELATION TO PLANTING BETWEEN GERMINATION AND INFECTION. SEVEN DAY TESTS AT 20°C.

Type of Treatment	Normal sprouts	Infected seedlings	Moldy seedlings
	%	%	%
	Alternaria Black Mold Infection		
Hot water	88	6	15
Mercurial dusts	77	8	2
Mercurial slurs	70	8	22
Oxide dusts	86	12	22
Control	65	12	23
	Fusarium Blight Type of Infection		
Hot water	84	8	12	4
Mercurial dusts	86	8	6	3
Mercurial slurs	83	5	1	11
Oxide dusts	88	8	6	22
Control	50	12	2	45
	Undetermined Type of Infection		
Hot water	71	7	1	5
Mercurial dusts	70	8	1	1
Mercurial slurs	75	5	2	2
Oxide dusts	69	8	5	5
Control	77	11	3	3
	Mixed Infection			
Hot water	82	7	3	45
Mercurial dusts	56	11	3	5
Mercurial slurs	63	7	11	18
Oxide dusts	58	11	22	12
Control	47	12	32	7

1. The average moisture of Syracuse dust is 7% per cent.

The data in Table 2 are typical of the action of the various types of treatments upon germination and control of fungi. As may be observed from Figure 2 the mercurials effected partial control of Alternaria spp. while cuprous oxide was less efficient.

When control of fungi alone is desired the mercurial dusts possess certain advantages over the other materials. It is essential, however, that the seeds be well covered with dust and that all of the non-adhering excess be removed. Semesan, an organic mercurial compound, has given consistently satisfactory results. The normal sprouts from Semesan treated seeds have averaged 8.2% more than those from all other mercurial dusts.

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SOME FUNGI ASSOCIATED WITH GRASS SEED [1]

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Only a few fungi have been reported as associates of grass seed. Orton [2] lists five parasitic fungi but does not mention saprophytotic species. Since Seymour [3] included 50 fungi as pathogenes of Kentucky bluegrass alone it is surprising that the list of seed-borne fungi is not more extensive. During the past year black fungus growths have been observed on germinating seeds of several grasses in the Geneva laboratory. Withered or blighted sprouts were also present and usually the plumules of the dead seedlings were discolored by fungi.

The trouble was very common to Kentucky bluegrass and occasionally occurred in tests of Canada bluegrass and rough bluegrass. Usually only a few dead seedlings were found in a 100-seed test but rarely a small group of 5 to 10 was killed. In the later instances the affected plumules were in contact with each other and the fungus probably spread from the originally infected seedlings to the others.

The withering was especially noticeable in Kentucky bluegrass and at the end of the 30-day germination period. The injury was not observed during the first 15 days of the test but became increasingly evident afterward. The coleoptiles appeared more resistant than the leaves although the former were occasionally killed and completely covered with mycelium and spores. Often the coleoptiles were healthy while the plumules were shrivelled and reduced to only one-third their normal diameter. A slight pull on the tip of the plumules severed it from the coleoptile.

Dead seeds of other grasses as shown in Figure 1 were blackened by fungus spores but no parasitic action has been observed. The development of the mycelium was limited to the glumes of live seeds. The more profuse growths always were noted on the dead seeds.

Most of the fungi which occurred on both seeds and sprouts were isolated and grown in pure culture. Prof. J. E. Machacek of the Dominion Laboratory of Plant Pathology at Winnipeg, Manitoba examined and identified one culture of each

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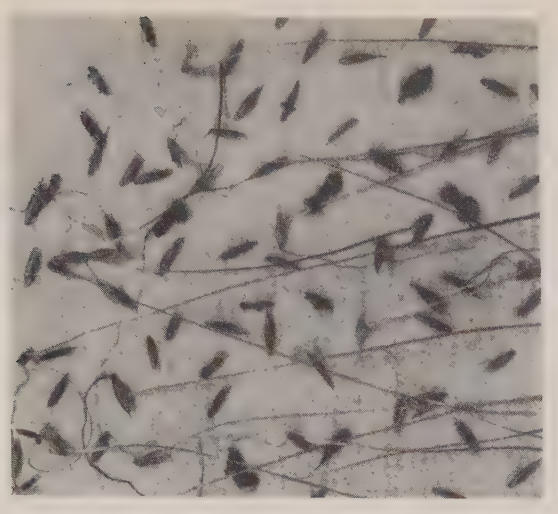

Figure 1 - Growths of Alternaria tenuis on dead seeds of red fescue. Slightly enlarged.

fungus. The fungi in order of their importance as contaminants of grass seeds are: Curvularia spicifera (Bainier) Boedijn, Alternaria tenuis Nees., Helminthosporium sativum P. K. and B., Fusarium moniliforme Shel., Helminthosporium halodes Dresch., Fusarium culmorum (W. G. Sm.) Sacc., Epicoccum purpurascens Ehrenberg, and Phoma glomerata Woll. and Hochct. Typical spores of each are illustrated in Figure 2. Occasionally fungi such as Aspergillus niger Link and Penicillum spp. were observed on the glumes of dead seed but were not isolated. Aspergillus niger may sporulate on the substratum without interfering with the germination of the seeds. Botrytis cinerea Pers. rarely invades strong sprouts of any grass but develops rapidly on dying seedlings.

Both Alternaria tenuis and Curvularia spicifera are saprophytes which occur on many seeds but usually are not parasitic to growing plants. A. tenuis frequently causes a blackening of the grains of oats but does not attack the groats or the developing seedlings. The glumes of germinating seeds of Poa spp. are commonly discolored by this fungus without any effect upon the caryopses. Seedlings of Poa spp., however, may be killed by A. tenuis and the spores are easily detected on the withered stems. (Figure 3).

Curvularia spicifera has never been observed at Geneva on the larger seeds of the family Gramineae. Examinations of germinating seeds of Poa spp. and other grasses indicate that this fungus is of common occurrence. Most of the black fungus growths on dead seeds, glumes and withered seedlings were shown to be due to Alternaria tenuis or Curvularia spicifera. In a critical study of germinating samples from 21 seedstocks of Kentucky bluegrass A. tenuis and C. spicifera were present on both dead seeds and infected seedlings in every test. Spores of Helminthosporium spp. were found on the withered sprouts in only two tests. Spores of Fusarium spp. were present on infected seedlings in only one test. Epicoccum purpurascens and Phoma glomerata were found only on the glumes of ungerminated seeds. Apparently these fungi do not infect normal seedlings.

Germinating seeds of Canada bluegrass and rough bluegrass were blackened by Alternaria tenuis and Curvularia spicifera. Spores of the other fungi mentioned above have not been observed. As many as 8% of the sprouts of rough bluegrass and 5% of those of Canada bluegrass have been killed by natural inoculation of A. tenuis and C. spicifera.

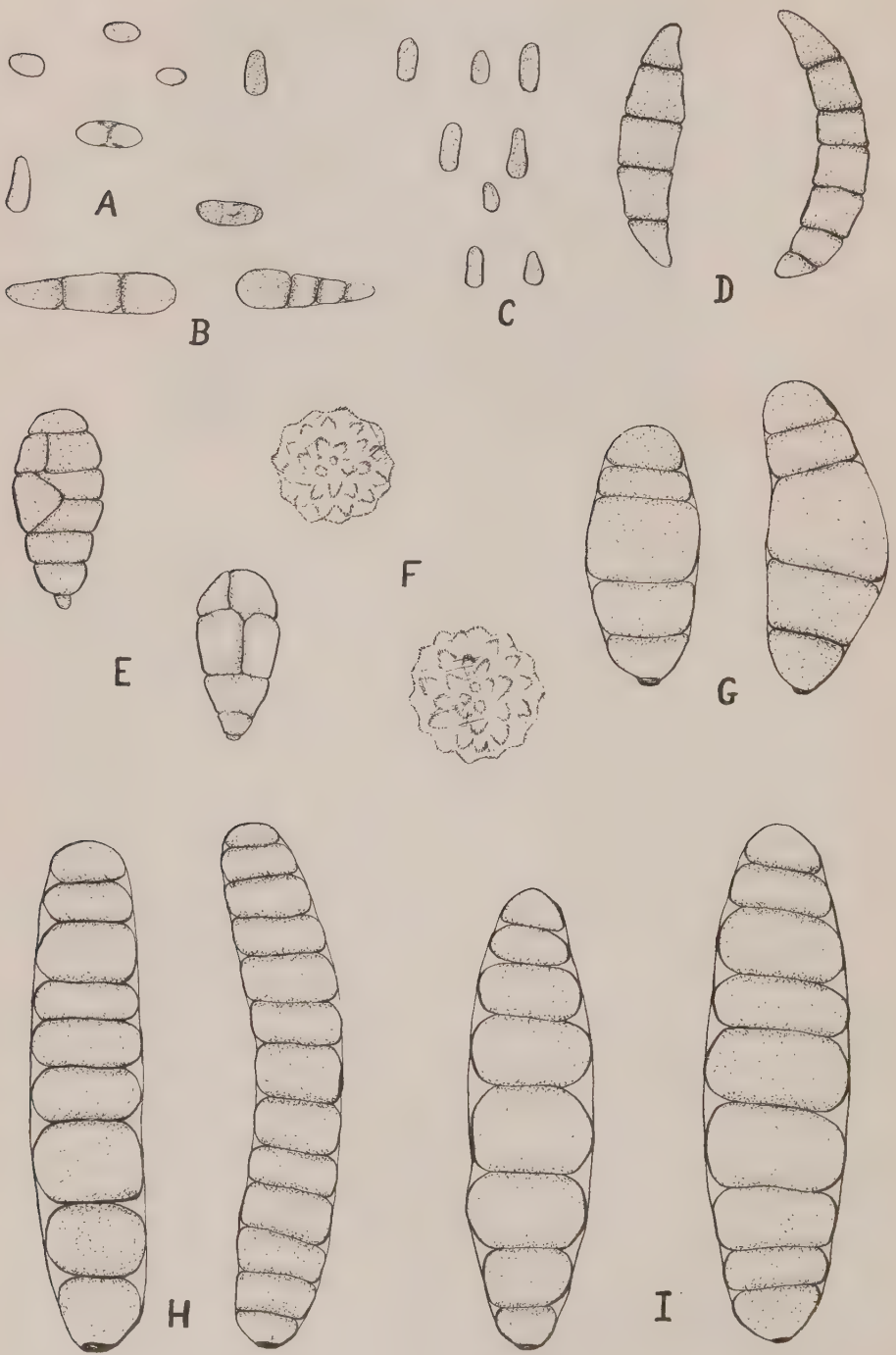

Figure 2 - Spores of the fungi occurring on germinating grass seeds. A. Fusarium moniliforme (microconidia), B. Fusarium moniliforme (macroconidia), C. Phoma glomerata, D. Fusarium culmorum, E. Alternaria tenuis, F. Epicoccum purpurascens, G. Curvularia spicifera, H. Helminthosporium halodes, I. Helminthosporium sativum. x 1200.

Figure 3 - Spores of Alternaria tenuis arising from a dead seedling of Kentucky bluegrass. x 200.

Seeds of the Festuca spp. are frequently discolored by Alternaria tenuis and Curvularia spicifera. Profuse growths of the former may be seen on several dead seeds of red fescue in Figure 1. Infected seedlings have not been observed regardless of the number of dead and fungus-covered seeds.

An instant dip in an 0.1% suspension of New Ceresan has reduced the number of blackened seeds in several lots of Kentucky bluegrass. This treatment did not depress the germination and apparently prevented some of the fungus injury to the seedlings. A much simpler control method, as is probably practiced in most laboratories, consists in removing the infected seedlings before they can contaminate the adjacent ones.

Examinations of seeds collected directly from standing Kentucky bluegrass did not demonstrate the presence of fungus spores. When spore suspensions of Alternaria tenuis or Curvularia spicifera, however, were atomized over the florets, the glumes of the mature seeds were discolored. A number of attached florets were soaked in spore suspensions of A. tenuis or C. spicifera for 24 hours. When the mature seeds were placed to germinate the glumes were blackened. This method of inoculation, however, did not increase the percentage of withered plumules as compared to those from normal seeds.

Plots of flowering Kentucky bluegrass were inoculated with spore suspensions of Helminthosporium sativum and Fusarium culmorum at the beginning of 12 and 20 hour periods of rainfall. The mature seeds were later collected and examined. Spores of Alternaria tenuis were seen in every lot of seed whereas only an occasional spore of H. sativum or F. culmorum was found.

Seedlings of Kentucky bluegrass, redtop and red fescue were inoculated with several fungi by atomizing spores over the plumules, placing mycelial masses on the coleoptiles and immersing the seeds and bases of the coleoptiles in spore suspensions. Similar results were obtained from each of these methods of inoculation. Alternaria tenuis slightly increased the percentage of dead seedlings in red fescue and Kentucky bluegrass but not in redtop. Curvularia spicifera was pathogenic to seedlings of Kentucky bluegrass and redtop but not to red fescue. Epicoccum purpurascens and Fusarium moniliforme possess no pathogenicity to any of these grasses. Fusarium culmorum killed 20% of the seedlings in red fescue but seemed not to infect Kentucky bluegrass and redtop. Helminthosporium sativum was

very pathogenic to these three grasses. In several tests every seedling was killed and the fungus sporulated abundantly on the dead tissue.

Helminthosporium sativum was also capable of killing seedlings when the mycelium was smeared over the seeds at the beginning of the germination period. Bermuda grass, Canada bluegrass, Chewings Fescue, Colonial bent, Crested wheatgrass, Domestic ryegrass, Kentucky bluegrass, Perennial ryegrass, Meadow fescue, Redtop, Rhode Island bent, Sheeps fescue and Tall Oat grass were included in this experiment. Only 20% of the seedlings of the latter grass were infected and 50% of both domestic and perennial ryegrass. From 85 to 100% of the seedlings of the other grasses were killed. H. sativum sporulated profusely on the dead tissues. No other fungus was found on either living or dead seedlings.

Similar tests with Curvularia spicifera indicated that this fungus was not as pathogenic as Helminthosporium sativum. Bermuda grass, domestice ryegrass and tall oat grass are not infected, while only 2 to 10% of the seedlings of the other grasses were killed. Alternaria tenuis was not pathogenic to Bermuda grass, perennial ryegrass or tall oat grass but effected a withering of 5 to 20% of the seedlings of the other grasses.

Bermuda grass, red fescue, Kentucky bluegrass and redtop were grown in pots and inoculated with each of the fungi isolated in this study. No leaf spots or other types of lesions were observed although the grasses were inoculated repeatedly over a period of 30 to 100 days from seeding. A saprophytic development of Helminthosporium sativum was observed on the naturally dead leaves at the end of the experiment. This fungus was more prevalent than either Alternaria tenuis or Curvularia spicifera and occurred on leaves in the control pots as well as in the inoculated growths. The other fungi either did not develop on dead leaves or were rapidly crowded out by H. sativum.

THE HEMOCYTOMETER METHOD FOR DETECTING FUNGOUS SPORE LOAD CARRIED BY WHEAT SEEDS

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Among the methods that have been utilized for the detection of seed borne organisms is that of a quantitative measure of fungous spores carried by any given seed lot. Such determination has been applied primarily to cereal seeds infested with the smut pathogens which in general are not injurious to germination and therefore do not express themselves on germinating seeds. On the other hand, the detection of fungi on seeds by some method of germination often requires a long period of time, hence a quick quantitative test should have a place in seed laboratory practice. Several workers have attacked this problem by investigating the feasibility of determining the spore load per kernel. Bolley (1)[1] and Cobb (2), (3) used the centrifuge to determine the smut spore load of wheat. Bolley also worked with flax seed and found that spores of Fusarium lini were present on 85% of the flax seed in the flax growing region of the Middle West. Cobb estimated that if one wheat plant in 1000 was bunted, when threshed there would be about 180 spores per kernel.

Heald (5) found that he could use a Levy counting cell (a modified hemocytometer) to better advantage than the centrifuge. Heald was the first to demonstrate that the bunt spore load of wheat was correlated with the amount of

1. Numbers in parentheses refer to Literature Cited.

smut appearing in the crop. In 1935 Davis (4) utilized the hemocytometer in the detection of oat smut spore load. The methods utilizing the Levy counting cell or hemocytometer have not been described amply enough for general use.

This paper describes the hemocytometer method as employed to estimate the spore load of several fungi carried by wheat seed. The only equipment needed was a microscope, a hemocytometer with cover glass, test tubes, corks, 1 and 5-ml pipette, a wash bottle and cheese cloth.

It was found that 100 seeds from a given lot were enough for a fair estimation of spore load. In all but the preliminary tests water was used as the dispersion medium. Alcohol did not seem to have any significant advantage. When shaken, the surface tension of water offered no great difficulty. For general purposes 5 ml of water was used. If the spore load is high more water can be used. One advantage in using more water is that the proportion of water absorbed by the seed is less, tending to make the estimate more accurate. However, practically no water is absorbed if the suspension is examined immediately. If less water is used so that a more concentrated suspension is obtained, the less frequent spores are more likely to be found.

To shake the tube and suspension for one-half hour as Heald did requires considerable time and effort. It was thought that uniform shaking and immediate observation of the suspension would be better. One hundred seeds were placed in a test tube and 5 ml of water added. The tube was corked and shaken vigorously 50 times. By means of a 1 ml pipette, which was kept free of spores by washing, wiping and blowing out after each operation, a sample of the liquid was taken. During this procedure the liquid was stirred so that the suspension was kept homogeneous. A drop of the suspension was placed on the hemocytometer and the cover glass was immediately set in place. The spores were then observed and counted in the measured volume of the hemocytometer from which the number of spores per kernel was readily calculated.

It was found by the chi square test that counting the number of spores in a quarter of the field of five different mounts gave a much better estimate of spore load per kernel than by counting the number of spores in the whole field of one mount.

It was suspected that all of the spores were not washed from the kernels in 50 agitations, therefore a test was made to determine the percent washed off. The preceeding technique was used to determine the number of bunt spores per hemocytometer field for each of five samples of wheat, then the spore suspensions were poured out of each tube. The washed seed was retained in the tubes and rinsed gently three times in order to rid the tube of any spores which adhered to the walls of the tube and seeds. Five ml of water were again added to each tube but the tubes were not shaken. This water was examined for spores. Finding only two in one of the tubes indicated that none of the spores in the first spore suspension were retained by the seeds. The tubes were again shaken vigorously 50 times each and spore counts per field were made as before. Spores were found again in each sample. The samples were rinsed three more times and observed for freedom of spores. Finding none, the tubes were shaken once more and only a few spores were found in each sample. The procedure was repeated on one sample and practically all of the bunt spores had been washed off. Table 1 shows the results of this experiment. On the basis of the total number of spores washed off in three washings involving 150 agitations it is concluded that about 85% of the bunt spores were washed off in the first 50 agitations, if the spore suspension was observed immediately.

A formula for computing the spore load per kernel was developed. Since four cubic mm were examined (that is five quarter fields of .8 cubic mm each), the volume examined is $\frac{1}{250}$ of a ml or $\frac{1}{1250}$ of 5 ml, the later being the quantity of water used for each 100 kernels. The formula then becomes $N = \frac{(x)\ 1250}{(.85)(100)} =$ (x) (14.7) in which x number of spores in 4 cubic ml of spore suspension and N number of spores per kernel.

Fifty seven farmers' samples of wheat were examined for infestation with spores of Tilletia, Alternaria or Macrosporium and Helminthosporium. A range of from 59 to 22,344 Tilletia spores, 0 to 10,584 Alternaria or Macrosporium spores; and 0 to 59 Helminthosporium spores per kernel were found.

A test was made to determine the relation of spore load of Helminthosporium sativum to development of disease symptoms on wheat seedlings in the laboratory. The results of the tests tabulated in Table 2 show that samples of wheat containing no spores of H. sativum as detected by the hemocytometer method developed typical symptoms of disease. One sample with a spore load of 29 per kernel developed no diseased seedlings in soil. This is no indication of freedom from injury done by H. sativum, however, because 18 seedlings counted as dead might have been killed by the pathogen before they emerged from the soil. No definite conclusions can be reached other than that spore load alone is not an adequate criterion for the extent of probable injury to germination by Helminthosporium.

TABLE 1. - DIMINISHING CONTRIBUTION OF BUNT SPORES BY WHEAT KERNELS FROM A SERIES OF WASHINGS.

	Spore loads per 3.2 cu. mm.*				
Sample	3	4	5	6	14
After first washing in 5 cc water (50 agitations)	56	60.8	60	81	61.6
After first rinsing 3 water changes 5 cc (no agitation)	0	0	1.6	0	0
After second washing in 5 cc water (50 agitations)	17	11	12	5.2	5.8
After second rinsing 3 water changes 5 cc (no agitation)	0	0	0	0	0
After third washing in 5 cc water (50 agitations)	2.6	1.4		1	
After third rinsing		0			
After fourth washing		.8			
Total	74	75.2	71.4	87	68.4
Percent of spores removed from each sample in first washing	75.6	80.9	85.4	93.1	90.1
Mean percentage of spores removed in first washing	85.2				

* The spore load of each sample is an average of five determinations.

TABLE 2. - THE RELATION OF SPORE LOAD OF HELMINTHOSPORIUM SATIVUM TO THE DEVELOPMENT OF SYMPTOMS ON WHEAT SEEDLINGS IN THE LABORATORY.

Range of spore load per kernel	Range in percent of diseased seedlings 200 or 400 seeds germinated for each determination; thirty samples represented in the experiment	
	Blotters	Soil
0 to 5.9	0 to 64	0 to 27
6 to 14.7	1 to 30	.25 to 18
14.8 to 29.4	29.4 to 32	0 to 24
29.5 to 44.1	25 to 39	22 to 24

An attempt was made to determine the relation of spore load of Alternaria or Macrosporium to the development of symptoms on the seedling. So few seedlings were affected that no conclusion can be drawn except that apparently the species involved are not parasitic to wheat under the conditions that existed.

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LABORATORY AND FIELD GERMINATION OF TREATED AND UNTREATED BEET SEED

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In 1936 three samples of beet seed were received from Sweden with the request that a germination test of each be made. Four, 100 seed ball subsamples of each sample were planted in bloters and in sand. In addition two hundred seed balls each of treated and untreated seed from each sample were planted in autoclaved soil. The disinfectant used was 1% ethyl mercury phosphate. Seedlings from each sample of untreated seed developed symptoms of Phoma betae which caused stem lesions and rotting of the seedlings either before or after emergence from sand or soil.

The number of normal sprouts obtained from each 100 seed balls in the different substrata as well as the number of diseased seedlings in the treated and untreated subsamples is shown in Table 1.

TABLE 1. - GERMINATION OF TREATED AND UNTREATED BEET SEED IN THE LABORATORY.

	Number of seedlings per 100 seed balls							
	Blotters		Sand		Soil			
	Untreated		Untreated		Treated		Untreated	
Sample	Normal	Diseased	Normal	Diseased	Normal	Diseased	Normal	Diseased
1	138	66	160	32	333	7	149	10
2	186	49	158	36	316	9	188	37
3	142	66	129	33	151	6	134	27
Mean	155.3	60.3	149	33.7	266.7	7.3	157	24.7

The data in Table 1 show that: 1, more diseased seedlings from untreated than from treated seed appeared in soil tests; 2, in autoclaved soil the treated seed produced 70% more normal seedlings than did untreated seed; and 3, the number of normal seedlings per 100 seed balls of untreated seed was not greatly different in either of the three substrata. On the basis of the number of normal seedlings produced by treated seed it seems evident that Phoma betae prevented the germination of many untreated seed in blotters and the emergence of many seedlings in both sand and soil.

In 1938, four samples of garden beet, one of mangel and eight of sugar beet seed were obtained for study. Each sample was divided into four parts, one was kept as an untreated check and the other three portions of each sample were treated with 1 and 5% ethyl mercury phosphate and semesan respectively. From each subsample 100 seed balls per row with four replications in randomized blocks were planted on April 18 and 19. After emergence, stand counts were made and recorded. Emergence was affected adversely by several beating rains which fell between the time of planting and of first emergence.

In May 1939 seed balls from the same subsamples were planted in blotters and in sand in the laboratory using 200 balls from each subsample for each substrate.

The results of the laboratory and field tests are shown in Table 2 from which it may be seen that the mean number of plants per row for all 13 samples ranged from 31.0 for the untreated seed to 52.1 for the seed treated with 5% ethyl mercury phosphate which is an increase of nearly 70% above that for untreated seed. All of the treatments had a beneficial effect on the emergence of seedlings in that a significantly greater number of seedlings were found in rows planted with treated than with untreated seed. Undoubtedly the lower germination of untreated than of treated seed in the field was caused by the attack of soil fungi.

In the laboratory the germination was not significantly different between treated and untreated seed planted in sand or in bloters for the samples as a whole. The variability was high which makes it difficult to measure the significance of small differences. Taken as a whole, the number of normal sprouts obtained from untreated seed in sand is significantly greater than in blotters. The same is true for the first treatment.

Approximately one-third as many sprouts per 100 seed balls was obtained in the field as in the laboratory which further indicates the unfavorable effect of climatic conditions on field germination.

These field results are similar to those obtained by Buchholtz (1)[1], Leach, (2), Clerg (3) and by Reddy and Buchholtz (4) with sugar beets. They also show that garden beets and mangel respond in a similar manner and that infection and injury casued by Phoma betae to Beta spp. in the germination chamber may be largely controlled by seed disinfection.

1. Numbers in parenthesis refer to Literature Cited.

TABLE 2. - LABORATORY AND FIELD GERMINATION OF TREATED AND UNTREATED BEET SEED

Sample		Mean number sprouts per 100 balls.											
		Check			1st treatment			2nd treatment			3rd treatment		
		Laboratory			Laboratory			Laboratory			Laboratory		
		Blotter	Sand	Field	Blotter	Sand	Field	Blotter	Sand	Field	Blotter	Sand	Field
Garden beets	1	70.0	106.5	15.5	116.5	138.0	46.5	133.5	142.0	54.8	137.0	145.5	24.5
	2	152.0	194.5	30.5	172.0	163.5	46.3	152.5	181.0	56.3	167.5	191.5	53.5
	3	55.5	128.5	28.3	123.0	127.0	24.0	124.5	113.5	49.8	69.5	127.5	31.3
	4	116.5	134.0	37.0	146.0	148.0	44.5	154.0	145.5	83.0	142.5	141.0	44.5
Mangel	5	78.5	164.0	34.3	128.0	117.0	55.0	146.0	149.5	41.0	48.5	123.0	51.3
Sugar beets	6	221.0	235.0	35.3	114.0	217.5	54.0	214.0	185.0	70.0	88.0	227.0	61.0
	7	199.0	214.0	36.3	194.5	205.5	75.3	198.0	199.5	57.5	74.0	225.0	62.8
	8	53.5	74.5	19.5	86.5	90.0	24.3	68.0	55.5	23.0	51.5	104.5	33.5
	9	128.0	182.0	42.3	150.0	182.5	42.3	153.5	175.0	64.0	145.0	158.5	57.8
	10	37.0	40.5	6.8	53.5	39.5	12.5	43.5	39.0	9.3	30.5	37.5	6.8
	11	107.0	145.5	42.3	106.0	128.5	56.0	115.0	132.5	55.3	89.0	149.5	46.8
	12	164.0	214.5	45.8	180.5	190.5	72.0	159.5	170.5	76.3	178.5	190.0	75.3
	13	86.0	119.0	29.3	93.5	115.0	37.5	97.0	102.0	35.8	110.0	109.5	43.3
Mean of all		112.9	148.2	31.0	128.0	143.5	45.3	135.3	137.6	52.1	102.4	148.5	45.3

1st treatment - 1% ethyl mercury phosphate.
2nd " - 5% " " "
3rd " - Semesan.

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WEED SEED CONTENT OF CULTIVATED SOILS

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This paper was taken from a larger publication by the same author entitled: Ecological Study of the Weed Population of Eastern Nebraska, Univ. Nebr. Studies. 39. 2: 29 - 91. 1939. (Pages 50-54 deal with weed seeds in cultivated soils).

STATE SEED LAWS AND THEIR APPLICATION TO DEALER AND GROWER

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State Department Agriculture, St. Paul, Minnesota

This paper is written in response to the article "State Seed Laws and The Weed Control Problem" by Earl M. Page, Corneli Seed Company, St. Louis, Missouri, published in the Seed World, April 7, 1939.

When I first read Mr. Page's article, I was somewhat concerned because he cited the Illinois laboratory as taking the lead for withdrawing all exemptions to the farmer, and he did not mention the many states which have required the farmer to label his seed for several years past.

Questionnaires were sent out to forty-eight states and replies were received from thirty-six. We had recent copies of seed laws from seven of those which did not reply, so this report should be quite complete.

Included with this report is a tabulation of special notes given in the returned questions.

Seventeen states have definite label requirements for farmers and 7 other states require farmer labeling under certain conditions. Seventeen states exempt farmers from labeling seed grown and sold on their own premises and not advertised or shipped by common carrier. Only one state completely exempts farmers from labeling seeds. No information was available or no labeling is required for 6 states.

It is evident that consideration is being given to remove most of the farmer exemption clauses from our state seed laws. The western part of the United States has no farmer exemption clause and the middle west is changing. The eastern and southeastern section also seem to be working toward the goal of withdrawing the clause.

Whether or not the quality of seed raised would improve if all the farmer exemption clauses were withdrawn is a question. Laws may be made, but the enforcement is another problem.

We have noticed that the grower in Minnesota is becoming more weed minded and pure seed minded. Of the 13-to 15,000 samples of seed that we have been receiving annually, about 70% are sent to us by the grower. It is true that some of them think that the test adds a mysterious value to the seed, but this past year, we had numerous requests for the names of custom cleaners where they might have their seed cleaned to comply with our state seed law.

NOTES REGARDING FARMER EXEMPTION CLAUSE AND LABEL REQUIREMENT

State	Label Required	Year Effective	No Label	Limited Requirement	Notes	Change Planned
Alabama	-	-	-	X	Exempt when sold and delivered on his own premises and not advertised for sale other than by word of mouth. Bill in legislature now to change this.	Yes
Arizona[1]	-	-	-	X	No label required when farmer sells on his own premises. Label required when advertised. Held responsible for representations. Forbidden to sell any seed containing noxious weed seeds.	
Arkansas[1]	-	-	-	X	Exceptions seed grown by farmer and sold on his own premises or to a merchant for recleaning. (1937 Seed Law)	
California	X	1922	-	-	No farmer exemption clause	
Colorado	X	1917	-	-	No farmer exemption clause	
Connecticut	X	1929	-	-	No farmer exemption clause	
Delaware	-	-	-	X	No label when sold by farmer to farmer and not sold through mail or by any common carrier. Bill offered at last session did not pass	
Georgia	-	-	-	-	No Seed Law	
Idaho[1]	X	1931	-	-	(1931 Seed Law)	
Illinois	X	1919	-	-	No farmer exemption clause	
Indiana	-	1921	-	X	No, provided he does not advertise the seed or deliver it away from the premises where grown.	No
Iowa	-	-	-	X	Exempt when sold on his own premises without advertising but not from selling seed containing primary noxious weed seeds in excess of legal amount. When he advertises or exposes seed for sale, the requirements are same as for dealer.	Yes
Kansas	-	1935	-	X	Farmer may sell on his own premises corn, sorghum,kaffir,wheat or rye which is not tested or labeled when both the grower and planter know that the seed grown in this land is free from noxious weeds. Prior to 1935, the clause was not limited.	
Kentucky	-	1932	-	X	Exempt when sold on the premises and not advertised or delivered.	Yes
Louisiana	-	-	X	-	Not required to label their seed when placed on the market if raised on their own place. Do not absolutely require them to have germination test made. However,we impress on them the importance of doing so.	Opinion that it should be changed
Maine[1]	-	-	-	-	Law pertains to certified seed of potatoes and vegetables (1927)	
Maryland	-	1918	-	X	No,unless they are advertised and delivered through common carrier.	No
Massachusettes	-	1939	-	X	May label "not tested" and give name and address-any retailer may do likewise. Label must comply with law. Farmers raise no seed for sale so not important.	No
Michigan	-	-	-	X	Permits sale of farmer's seed to his neighbor without complying with tagging requirements. Applies only to seed that he grows himself and has not advertised for sale. If seed has received publicity it must be labeled.	No
Minnesota	X	1927	-	-	Complete label required	No
Mississippi[1]	-	-	-	-		
Missouri	-	-	-	X	Needs no label - but is liable if he labels - also if he ships or by common carrier.	No
Montana	X	1913	-	-	No exemption clause	No
Nebraska	-	1929	-	X	Required to label all grasses and small seeded legumes.	
Nevada[1]	-	-	-	-	No farmer exemption clause in 1929 law on file	
New Hampshire[1]	-	-	-	-		
New Jersey	-	1931	-	X	Exempt from labeling when sold farmer to farmer on own premises and not advertised provided said framer is responsible for any respresentations he shall make in sale of such seeds. Previous to 1931, anyone was permitted to sell seeds"not tested".	No
New Mexico[1]	-	-	-	-		

- Continued-

NOTES REGARDING FARMER EXEMPTION CLAUSE AND LABEL REQUIREMENT - Concluded

State	Label Required	Year Effective	No Label	Limited Requirement	Notes	Change Planned
New York	-	1917	-	X	Must label all seed sold, except cereals of his own growing sold on his own premises, but must label these when advertised or delivered.	
North Carolina	X	1929	-	-	Anyone doing a retail business, farmer or dealer must label	
North Dakota	-	-	-	X	Farmer is exempt if he sells or exchanges seed within any community - if he is not engaged in commercial seed business	No
Ohio	-	1919	-	X	Must label if he advertises or ships by common carrier. Feel that the farmer should be required to label any seed he sells. He is held for a license fee if he advertises it. 100 farmers licensed last year.	
Oklahoma	-	1919	-	X	If a farmer sells seed on his own premises without advertising them, he is not required to label.	Plan to change to conform to Federal Act
Oregon	X	1937	-	-		
Pennsylvania	X	1921	-	-		
Rhode Island[1]	X	1929	-	-	No exemption clause in law of 1929 on file	
South Carolina	-	1922	-	X	Exempt when sold on the premises for seeding purposes by the purchaser. If a certificate is given with the sale, he is liable.	
South Dakota	-	-	-	X	No label required when sold on farm without being advertised	No
Tennessee	-	1939	-	X		
Texas	-	1929	-	X	Must label if they advertise through U.S. mail or any publication. If sold as tested seed must be labeled regardless. If not tested, must be labeled "not tested".	
Utah	X	for several years	-	-	Regulation, not law. Have not considered making it a law. The regulation can be changed by the Board of Agriculture.	
Vermont	-	-	-	X	No label required when sold and delivered on the farm where grown. 1926	
Virginia	-	-	-	X	Farmer exempt provided seed is sold on his own premises and provided also that the farmer does not ship by mail or common carrier.	
Washington	X		-	-		
West Virginia	-	-	-	X	Law does not apply to the sale of seed that is grown on the farmers own premises and sold and delivered thereon to be used for seeding purposes by purchaser.	
Wisconsin	X	1909	-	-		
Wyoming[1]	X	-	-	-	Looked up laws of 1929 - No farmer exemption clause	

[1]No reply to questionnaire. Information, if given, is from most recent law on file.

CONSTITUTION AND BY-LAWS

ASSOCIATION OF OFFICIAL SEED ANALYSTS
Adopted August 4, 1939

Constitution

Article I
Name

The name of this organization shall be "The Association of Official Seed Analysts", hereafter referred to as the Association.

Article II
Object

The object of this Association shall be to improve seed testing in all its branches and to make it more useful to agriculture and society. The object shall be obtained through cooperative effort by:

(a) promoting uniform laboratory methods and practices through seed research.
(b) conducting referee tests among laboratories and among individual workers.
(c) furthering the exchange of ideas among laboratories and among individual workers.
(d) fostering effective workable seed control legislation and regulation.
(e) promoting a more general appreciation of the benefits of seed testing to farmers and seedsmen.

Article III
Membership

1. The membership shall consist of Member Laboratories, Associate Members and Honorary Members.

2. Member Laboratories shall consist of groups of individuals working as seed analysts or workers on seed research problems in recognized government seed laboratories. Each such laboratory shall have one vote cast by an accredited and qualified member of the laboratory staff. Each laboratory entitled to vote shall be in good standing.

3. Individuals working on seed analysis in member laboratories shall automatically become associate members. Persons not attached to the staffs of member laboratories, who are working on seed analysis, seed research or kindred work, may be elected as associate members on the recommendation of the Membership Committee. Associate members are eligible to take office in the Association and may enter motions but are not entitled to vote except as provided in Article III, Section 2.

4. Honorary Members. Any person who has rendered signal service in one or more of the fields of activity of the Association mentioned in Article II, is eligible for Honorary Membership.

Article IV

Officers and Executive Board

1. The officers of the Association shall be:

President
Vice-President
Secretary-Treasurer

2. The Executive Board shall be:

President
Vice-President
Secretary-Treasurer,
Immediate Past President,
Chairmen of the Standing Committees.

3. The terms of all officers unless otherwise provided shall be for one year beginning at the close of an annual meeting and ending with the close of the nex annual meeting or until successors have been elected.

Article V

Committees

1. The classes of Committees of the Association shall be Standing, Special and Sub-Committees.

2. There shall be six Standing Committees as follows:

(a) Research
(b) Editorial
(c) Public Service
(d) Legislative
(e) Rules and Regulations
(f) Membership

3. The Chairman of each Committee shall be appointed by the President, the Chairman of the Research Committee to be selected from members of that Committee. The Chairman of each committee shall appoint the members of his committee with the consent of the President. For Research Committee see Article V, Section 5.

4. The tenure of office of each committee member, with the exception of the Research Committee, shall be for one year or until his successor is appointed and qualified.

5. The Research Committee shall consist of five members representing five districts of the United States and Canada, each member to serve five years. One member shall be appointed each year by the Chairman of the Committee with the approval of the President.

A permanent sub-committee shall be appointed to study the relationship of phytopathological technique to seed laboratory practice. Other sub-committees may be appointed to investigate special problems as they arise. All such appointments shall be made by the Chairman of the Research Committee, with the approval of the President.

6. The Editorial Committee shall consist of the editors of the Proceedings, News Letter and Handbook; the Historian and the bibliographer. The editor of the Proceedings shall be chairman of the committee.

7. Special committees shall be those other than the six standing committees and the sub-committees. These committees shall include the following and other committees which may be appointed by the President:

(a) Program
(b) Nominations
(c) Auditing
(d) Resolution
(e) Constitution

8. In so far as practicable associate members shall not be members of more than one Standing, one Special and one Sub-Committee at the same time.

Article VI
Election of Officers

Officers shall be elected by ballot. The ballots shall be prepared by the Nominations Committee and submitted to the members by the Secretary-Treasurer. The method of voting shall be as set forth in the By-Laws.

Article VII
Vacancies

Should a vacancy occur in the Presidency, the Vice-President shall become acting President. In the case of a vacancy in any other elective office, the same may be filled for the unexpired term by a person appointed by the President or acting President.

Article VIII
Publications

The official publications shall be the Proceedings, the News Letter,the Hand Book of Seed Testing and such special publications as may be provided or ordered by the Executive Board.

Article IX
Meetings

1. The annual meeting of the Association shall be held at such time and place as shall be determined by the Executive Board. The time and place of the annual meeting shall be announced through the medium of the News Letter or in writing by the President to the membership of the Association at least six months before the meeting.

2. Special meetings of the Association and of the Executive Board may be held subject to the approval of the Executive Board and the call of the President.

3. The Executive Board shall meet some time during the three days proceding the opening date of the annual meeting of the Association.

Article X
Dues

The amount of annual dues of member laboratories shall be determined according to the needs of the Association and as may be decided at any regular meeting, and shall be due and payable on or before the first day of April of each year.

Article XI
By-Laws

The Association shall adopt By-Laws.

Article XII
Amendments to Constitution

Changes in the Constitution must be submitted in writing to the Chairman of the Committee on Constitution. These changes will be presented at one annual meeting and voted on at the next. A vote of two-thirds of the member present shall be necessary to adopt the amendment.

By-Laws

By-Law I
Election of Officers

1. At least two months previous to the Annual Meeting the Secretary-Treasurer shall send to the member laboratories nomination forms which act as a preliminary ballot. These completed forms shall be sent to the Chairman of the Nominations Committee. The Secretary-Treasurer will then prepare ballots as instructed by the Nominations Committee and forward them to the member laboratories. This ballot shall consist of not less than two or not more than three names for each office. Ballots will be submitted to the Chairman of the Nominations Committee. A plurality vote will elect. In the case of a tie vote the Executive Board shall decide the election.

2. The President shall announce the newly elected officers at the close of the Annual Meeting.

By-Law II
Membership

1. All member laboratories in good standing on the date of adoption of this constitution shall automatically become members of the Association. This shall not exclude any person who was a member prior to June 1st, 1938.

2. The application of laboratories for membership, and of individuals for associate membership in the Association, must be submitted to the Membership Committee. If approved, the names of applicants will be submitted to the Annual Meeting for election.

3. Honorary Members shall have all privileges of Associate Members except that of holding office. Any Associate Member may nominate a person for Honorary Membership. Such nomination shall be submitted to the Membership Committee. If approved, the name will be presented to the delegates at the Annual Meeting. They shall be declared elected upon a two-thirds majority vote.

By-Law III
Officers

1. It shall be the duty of the President to preside at all meetings of the Association, to perform the usual duties of such office, and in addition:

(a) Serve as Chairman of the Executive Board
(b) Appoint all committee chairmen
(c) Approve appointment committee members.

2. The Vice-President shall be chairman of the Program Committee and act as President upon the completion of the term of office as Vice-President, except that, in case of inelgibility or resignation, the vacancy shall be filled as provided in Article VII, Section 1, of the Constitution.

3. The Secretary-Treasurer shall perform the duties common to that office in all organizations, and, in addition, shall receive all moneys for dues or from other sources, and acknowledge receipt of the same. He shall deposit to the credit of the Association in a recognized bank all moneys received and pay out therefrom such accounts as are approved by the Executive Board. He shall also serve as secretary to the Executive Board, send out to the member laboratories and receive nomination forms, and shall also prepare and send out ballots. The Secretary-Treasurer shall be bonded; the amount to be decided by the Executive Board.

4. The Executive Board shall:

(a) Transact the business of the Association when the Association is not in session, except in all matters pertaining to policies of the Association and in matters affecting the Constitution and By-Laws. These shall be submitted to the Association for approval at any annual meeting.

(b) Be responsible for the programme at the annual meeting.

(c) Decide an election in case of a tie vote.

By-Law IV

Standing Committees

1. The Research Committee shall initiate and supervise such research projects, either regionally or for the entire Association, as may lead to greater accuracy and uniformity in seed analysis, and publish the results of such studies, and make recommendations for changes in "Rules for Seed Testing" when adequate information for such changes has been obtained. This committee shall also conduct "Referee Tests" among seed analysts for the purpose of standardizing testing and analytical technique.

2. The Editorial Committee shall edit the papers and reports given at the Annual Meeting, and edit and publish (a) the Proceedings of the Association, (b) the News Letter, (c) the Handbook of Seed Testing, (d) the History of the Association, and (e) the Seed Bibliography.

3. The Public Service Committee shall study the methods of seed production, merchandising, inspection, and control, and the educational methods employed by national and state agencies designed to aid in the use of better seed. This committee shall also publicize the results of the studies and endeavor to develop a greater consciousness of the importance and value of high quality seed to American agriculture.

4. The Legislative Committee shall study the seed laws and regulations of the Federal Department of Agriculture and the Dominion Department of Agriculture and Agricultural Departments of the several States; and shall prepare a seed law as nearly as possible uniformly adaptable to use in the several States and to suggest such matters of legislation and regulation as may be advisable.

5. The Rules and Regulations Committee shall provide for the method of changing the Rules and Recommendations for Seed Testing and such definitions as the Association may adopt; shall conduct a study of rules and regulations; report and make recommendations for improvements as new information becomes available.

6. The Membership Committee shall receive and make recommendations concerning applications for membership in the Association. The Committee has the privilege of submitting names for honorary membership for election at the Annual Meeting. The Committee should consist of not less than seven members.

By-Law V

Special Committee

1. Nominations Committee shall receive nominations and count ballots in accordance with By-Law I, Section 1 of the By-Laws.

2. Auditing Committee shall audit the Secretary-Treasurer's accounts and other financial account.

3. Resolution Committee shall prepare resolutions for approval at the Annual Meeting.

4. Committee on Constitution shall receive amendments to the By-Laws and publish them in the News Letter at least two months prior to an annual meeting at which they may be presented for approval.

5. The Programme Committee shall prepare suitable programmes for all meetings of the Association.

6. It shall be the duty of the chairman of each committee to submit a written report at the annual meeting.

By-Law VI

Sub-Committees

A sub-committee may be appointed by the chairman of any committee on the approval of the President.

By-Law VII

Publications

1. The Annual Proceedings shall embrace reports, papers and the Minutes of the annual meeting. These Minutes shall be approved by the Executive Board.

2. The News Letter shall be compiled, printed and distributed by the editor of the News Letter.

3. The Handbook on Seed Testing shall be compiled by the editor of the Handbook.

4. The History of the Association shall be compiled by the Historian.

5. Special publications shall be edited and published as the Executive Board may direct.

6. Copies of the "Proceedings of the Association" shall be furnished to the member laboratories in good standing, the agricultural libraries of institutions where such laboratories are located, to members of the International Seed Testing Association, to honorary members of the Association of Official Seed Analysts, and to authors of papers in such "Proceedings". Other copies of the "Proceedings" shall be distributed and sold as the Executive Board may direct.

7. Copies of the "News Letter" shall be furnished to member laboratories in good standing, in the ratio of one copy for every ten associate members or fraction thereof. Other copies of the "News Letter" shall be distributed as the Executive Board may direct.

By-Law VIII

Annual Dues

The annual dues of the Association shall be ten dollars for each member laboratory unless changed at the regular meeting of the Association as provided in Article X of the Constitution.

By-Law IX

Order of Business

1. The suggested order of business at all regular meetings of the Association is as follows:

(a) Call to order
(b) Roll-call by laboratories
(c) Reports of the Executive Board and Standing Committees.
(d) Reports of special committees
(e) President's address
(f) Unfinished business
(g) Program and discussion
(h) Consideration and adoption of reports
(i) New business
(j) Installing of newly elected officers
(k) Adjournment

2. A quorum of any regular meeting shall consist of not less than ten representatives of member laboratories present and in good standing.

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